HP 3457A Multimeter

HP 3457A
Service Manual

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SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Under certain conditions, dangerous voltages may exist even with the instrument switched off. To avoid injuries, always disconnect input voltages and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DO NOT OPERATE A DAMAGED INSTRUMENT

Whenever it is possible that the safety protection features built into this instrument have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the instrument until safe operation can be verified by service-trained personnel. If necessary, return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

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Operating and Safety Symbols

Symbols Used On Products And In Manuals

~ LINE	AC line voltage input receptacle.
⚠	Instruction manual symbol affixed to product. Cautions the user to refer to respective instruction manual procedures to avoid possible damage to the product.
ϟ	Indicates dangerous voltage – terminals connected to interior voltage exceeding 1000 volts.
⏚ OR (⏚)	Protective conductor terminal. Indicates the field wiring terminal that must be connected to earth ground before operating equipment – protects against electrical shock in case of fault.
(⏚)	Clean ground (low-noise). Indicates terminal that must be connected to earth ground before operating equipment – for single common connections and protection against electrical shock in case of fault.
⫩ OR ⊥	Frame or chassis ground. Indicates equipment chassis ground terminal – normally connects to equipment frame and all metal parts.
⚠ ATTENTION Static Sensitive	Affixed to product containing static sensitive devices – use anti-static handling procedures to prevent electrostatic discharge damage to components.
NOTE	**NOTE** *Calls attention to a procedure, practice, or condition that requires special attention by the reader.*
CAUTION	**CAUTION** *Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.*
WARNING	**WARNING** *Calls attention to a procedure, practice, or condition that could possibly cause bodily injury or death.*

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SECTION I
GENERAL INFORMATION

WARNING

The information contained in this manual is intended for the use of service trained personnel who understand electronic circuitry and are aware of the hazards involved. Do not attempt to perform any of the procedures outlined in this manual unless you are qualified to do so.

1-1. INTRODUCTION

1-2. This manual contains information relating to the installation, operation, performance testing, calibration, and service of the HP 3457A Multimeter. The information is designed for the use of service trained personnel. Other users should refer to the HP 3457A Operating Manual.

1-3. MANUAL DESCRIPTION

1-4. The following paragraphs provide a general description of the manual layout and content:

Section I. General Information

Section I contains a brief description of the manual, and a general description of the instrument. This section also contains the instrument specifications and information concerning options and accessories.

Section II. Installation Procedures

Section II contains information to prepare the HP 3457A for use. Included in this section is power requirements, line voltage selection, and interfacing information.

Section III. Operating Instructions

Section III contains operating instructions necessary to service the HP 3457A. These operating instructions are a condensed version of those contained in the Operating, Programming and Configuration Manual.

Section IV. Performance Tests

Section IV contains information and procedures required to test the HP 3457A to its rated specifications. Also included in this section is a condensed version of the performance test (operational verification test) which will provide a more rapid test and give a 90% confidence that the instrument will meet its specifications.

Section V. Calibration

Section V contains procedures required to calibrate the HP 3457A to its rated specifications.

Section VI. Replaceable Parts

Section VI lists part numbers for cabinet parts and printed circuit assemblies.

Section VII. Manual Backdating

Section VII contains information required to adapt this manual to instruments whose serial numbers are lower than those listed on the title page.

Section VIII. Service

Section VIII contains a block diagram theory of operation, schematic diagrams, and procedures to aid in troubleshooting the HP 3457A.

1-5. INSTRUMENT DESCRIPTION

1-6. The HP 3457A is a versatile high precision digital multimeter which measures ac or dc volts, ac or dc current, ac+dc volts or current, resistance, frequency and period. It measures voltages up to 300 Vac or 300 Vdc with high dc resolution and accuracy. The instrument is designed for both bench and system use. Program and reading storage are included to allow high speed measurement applications with reading rates of greater-than 1000 readings per second. Provision has been made for optional assemblies such as a general purpose scanner or multiplexer assembly.

1-7. SAFETY CONSIDERATIONS

1-8. The HP 3457A is a safety class 1 instrument (provided with a protective earth terminal). The instrument and manual should be reviewed for safety markings and instructions before operation. Refer to the Safety Summary preceding this section for appropriate safety instructions and markings covering this instrument.

1-9. INSTRUMENTS COVERED BY THIS MANUAL

1-10. Instruments covered by this manual are identified by a serial number prefix listed on the title page. Hewlett-Packard uses a two part serial number in the form XXXXAYYYYY, where XXXX is the serial prefix, A is the country of origin (A=USA) and YYYYY is the serial suffix. The serial number prefix identifies a series of identical instruments. The serial number suffix is assigned sequentially and is unique to each instrument.

1-11. If the serial number prefix of your instrument is greater than the one listed on the title page, a yellow Manual Changes supplement will explain how to adapt this manual to your instrument.

1-12. If the serial number prefix of your instrument is lower than the one listed on the title page, information contained in Section VII (Manual Backdating) will explain how to adapt this manual to your instrument.

1-13. SPECIFICATIONS

1-14. Specifications for the HP 3457A Multimeter are listed in Table 1-1. These specifications are the performance standards which the instrument is guaranteed to meet.

Table 1-1. Specifications

DC VOLTS

INPUT CHARACTERISTICS:

RANGE	MAXIMUM READING 6 1/2 digits	RESOLUTION 6 1/2 digits	5 1/2 digits	4 1/2 digits	3 1/2 digits
30 mV	30.30000 mV	10 nV	100 nV	1 uV	10 uV
300 mV	303.0000 mV	100 nV	1 uV	10 uV	100 uV
3 V	3.030000 V	1 uV	10 uV	100 uV	1 mV
30 V	30.30000 V	10 uV	100 uV	1 mV	10 mV
300 V	303.0000 V	100 uV	1 mV	10 mV	100 mV

INPUT RESISTANCE (OHMS):

30 millivolt through 3 volt range - 10 gigaohms
30 volt and 300 volt range - 10 megohms (+/- 1%)

MAXIMUM INPUT VOLTAGE: (non-destructive)

HI or LO to Earth Ground: ± 450V peak

MEASUREMENT ACCURACY: ±(% of reading + Number of Counts)

Auto-Zero ON

24 HOUR: Tcal ± 1°C 2 hour warm-up Accuracy relative to calibration standard

24 hour specifications apply if the instrument is calibrated between 90 and 100% of full-scale. For calibration between 33 and 90% of full-scale, add .00015% to % Reading.

RANGE	% READING	NUMBER OF COUNTS 100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
30 mV	0.0012	215	235	350	55	17	6
300 mV	0.0005	24	25	35	7	4	4
3 V	0.00035	5	6	6	4	4	4
30 V	0.00065	9	10	20	6	4	4
300 V	0.0025	5	6	6	4	4	4

90 DAY: Tcal ± 5°C After 1 hour warm-up

RANGE	% READING	NUMBER OF COUNTS 100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
30 mV	0.0040	365	385	500	70	19	6
300 mV	0.0025	39	40	50	9	4	4
3 V	0.0017	6	7	7	4	4	4
30 V	0.0035	19	20	30	7	4	4
300 V	0.0050	6	7	7	4	4	4

Table 1-1. Specifications

DC VOLTS (Cont'd)

1 YEAR: Tcal ± 5°C After 1 hour warm-up

RANGE	% READING	NUMBER OF COUNTS					
		100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
30 mV	0.0045	365	385	500	70	19	6
300 mV	0.0035	39	40	50	9	4	4
3 V	0.0025	6	7	7	4	4	4
30 V	0.0040	19	20	30	7	4	4
300 V	0.0055	6	7	7	4	4	4

* PLC = Integration Time in Power Line Cycles. When using integration times of 100 PLC, 10 PLC, or 1PLC; multiply Number of Counts in the Measurement Accuracy Tables by 0.1 for 5 1/2 digit readings, 0.01 for 4 1/2 digit readings and 0.001 for 3 1/2 digit readings.
Tcal = the temperature of the environment where the 3457A was calibrated. Calibration should be performed with the environment temperature between 18 and 28 degrees centigrade.

TEMPERATURE COEFFICIENT: ±(% of Reading + Number of Counts)/°C
6 1/2 Digits Displayed

RANGE	Auto-Zero ON	Auto-Zero OFF*
30 mV	.0005 + 30	.0005 + 40
300 mV	.0005 + 3	.0005 + 13
3 V	.0005 + .3	.0005 + 10.3
30 V	.0005 + 1.0	.0005 + 11.0
300 V	.0005 + .3	.0005 + 10.3

* Specifications given are for a stable environment (± 1°C) and over a ten minute period. Multiply Number of Counts by 0.1 for 5 1/2 digit readings, 0.01 for 4 1/2 digit readings and 0.001 for 3 1/2 digit readings.

NOISE REJECTION:
With 1 Kohm imbalance in the LO lead and line frequency (50 or 60 Hz) ± 0.08%.

	INTEGRATION TIME					
	100 PLC	10 PLC	1 PLC	.1 PLC	.005 PLC	.0005 PLC
AC NMR	90 db	80 db	60 db	0 db	0 db	0 db
AC ECMR	160 db	156 db	136 db	76 db	76 db	76 db
DC CMR	140 db	140 db	140 db	140 db	140 db	140 db

Table 1-1. Specifications

DC VOLTS (Cont'd)

MAXIMUM READING RATES: (Readings/Second)

INTEGRATION TIME	DIGITS DISPLAYED	READING RATE 60 HZ	50 Hz
0.0005 PLC	3 1/2	1350	1350
0.005 PLC	4 1/2	1250	1250
0.1 PLC	5 1/2	360	312
1 PLC	6 1/2	53	45
10 PLC	6 1/2	4.8	4.0
100 PLC	6 1/2	.48	.40

Reading Rates apply with the keyboard lock ON, Auto-Zero OFF, Display OFF, Math Function OFF, Delay Time set to 0.0, Manual ranging, readings stored in internal memory using Timer Trigger and single precision integer format.

DC CURRENT

INPUT CHARACTERISTICS:

RANGE	MAXIMUM READING 6 1/2 digits	RESOLUTION 6 1/2 digits	5 1/2 digits	4 1/2 digits	3 1/2 digits	SHUNT RESISTANCE
300 uA	303.0000 uA	100 pA	1 nA	10 nA	100 nA	1000 Ohm
3 mA	3.030000 mA	1 nA	10 nA	100 nA	1 uA	100 Ohm
30 mA	30.30000 mA	10 nA	100 nA	1 uA	10 uA	10 Ohm
300 mA	303.0000 mA	100 nA	1 uA	10 uA	100 uA	1 Ohm
1 A	1.000000 A	1 uA	10 uA	100 uA	1 mA	.1 Ohm

MAXIMUM BURDEN VOLTAGE: 0.35V - 300uA, 3mA and 30mA ranges. 0.6V - 300mA range. 1 V - 1A range.

MEASUREMENT ACCURACY: ±(% of reading + Number of Counts)
After 1 hour warmup, with Auto-zero ON.

24 HOUR: Tcal ± 1°C After two hour warm-up. Accuracy relative to calibration standard.

RANGE	% READING	NUMBER OF COUNTS 100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
300 uA	0.0020	54	54	65	9	5	4
3 mA	0.002	54	54	65	9	5	4
30 mA	0.0020	54	54	65	9	5	4
300 mA	0.03	154	154	165	19	6	4
1 A	0.03	504	504	515	54	9	5

Table 1-1. Specifications

DC CURRENT (Cont'd)

90 DAY: Tcal ± 5°C After one hour warm-up.

RANGE	% READING	NUMBER OF COUNTS					
		100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
300 uA	0.020	104	104	115	14	5	4
3 mA	0.020	104	104	115	14	5	4
30 mA	0.020	104	104	115	14	5	4
300 mA	0.070	204	204	215	24	6	4
1 A	0.070	604	604	615	64	10	5

1 YEAR: Tcal ± 5°C After one hour warm-up.

RANGE	% READING	NUMBER OF COUNTS					
		100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
300 uA	0.04	104	104	115	14	5	4
3 mA	0.04	104	104	115	14	5	4
30 mA	0.04	104	104	115	14	5	4
300 mA	0.08	204	204	215	24	6	4
1 A	0.08	604	604	615	64	10	5

* PLC = Integration Time in Power Line Cycles. When using integration times of 100 PLC, 10 PLC, or 1PLC; multiply Number of Counts in the Measurement Accuracy Tables by 0.1 for 5 1/2 digit readings, 0.01 for 4 1/2 digit readings and 0.001 for 3 1/2 digit readings.
Tcal = the temperature of the environment where the 3457A was calibrated. Calibration should be performed with the environment temperature between 18 and 28 degrees centigrade.

TEMPERATURE COEFFICIENT: ±(% of Reading + Number of Counts)/°C
6 1/2 Digits Displayed

RANGE	Auto-Zero ON	Auto-Zero OFF*
300 uA	.002 + 20	.002 + 30
3 mA	.002 + 20	.002 + 30
30 mA	.002 + 20	.002 + 30
300 mA	.007 + 20	.007 + 30
1 A	.007 + 20	.007 + 30

* Specifications given are for a stable environment (± 1°C) and over a ten minute period. Multiply Number of Counts by 0.1 for 5 1/2 digit readings, 0.01 for 4 1/2 digit readings and 0.001 for 3 1/2 digit readings.

Table 1-1. Specifications

DC CURRENT (Cont'd)

MAXIMUM READING RATES: (Readings/Second)

INTEGRATION TIME	DIGITS DISPLAYED	READING RATE 60 HZ	READING RATE 50 Hz
0.0005 PLC	3 1/2	1350	1350
0.005 PLC	4 1/2	1250	1250
0.1 PLC	5 1/2	360	312
1 PLC	6 1/2	53	45
10 PLC	6 1/2	4.8	4.0
100 PLC	6 1/2	.48	.40

Reading Rates apply with the keyboard lock ON, Auto-Zero OFF, Display OFF, Math Function OFF, Delay Time set to 0.0, Manual ranging, readings stored in internal memory using Timer Trigger and single precision integer format.

RESISTANCE
(2-Wire Ohms, 4-Wire Ohms, Offset Compensated Ohms)

INPUT CHARACTERISTICS:

RANGE (OHMS)	MAXIMUM READING 6 1/2 digits	RESOLUTION 6 1/2 digits	RESOLUTION 5 1/2 digits	RESOLUTION 4 1/2 digits	RESOLUTION 3 1/2 digits	CURRENT THROUGH UNKNOWN
30	30.30000 Ohm	10 uOhm	100 uOhm	1 mOhm	10 mOhm	1 mA
300	303.0000 Ohm	100 uOhm	1 mOhm	10 mOhm	100 mOhm	1 mA
3 k	3.030000KOhm	1 mOhm	10 mOhm	100 mOhm	1 Ohm	1 mA
30 k	30.30000KOhm	10 mOhm	100 mOhm	1 Ohm	10 Ohm	100 uA
300 k	303.0000KOhm	100 mOhm	1 Ohm	10 Ohm	100 Ohm	10 uA
3 M	3.030000MOhm	1 Ohm	10 Ohm	100 Ohm	1 KOhm	1 uA
30 M	30.30000MOhm	10 Ohm	100 Ohm	1 KOhm	10 KOhm	100 nA
300 M*	303.0000MOhm	100 Ohm	1 KOhm	10 KOhm	100 KOhm	100 nA
3 G*	3.030000GOhm	1 KOhm	10 KOhm	100 KOhm	1 MOhm	100 nA

* On the Extended Ohms ranges (300 MOhm & 3 GOhm), the current source is 100 nA in parallel with 10 MOhms.

INPUT PROTECTION: (non-destructive)
HI sense to LO sense: ±350V peak.
HI or LO to Earth ground: ±450V peak.

MAXIMUM OPEN CIRCUIT VOLTAGE:
30 Ohm to 3 Megohm ranges: 12 volts
30 Megohm to 3 Gigaohm ranges: 8.5 volts

Table 1-1. Specifications

RESISTANCE (Cont'd)

MEASUREMENT ACCURACY - FOUR-WIRE OHMS: ±(% of reading + Number of Counts)
Auto-zero ON.

24 HOUR: Tcal ± 1°C
After two hour warm-up. Accuracy relative to calibration standard.

RANGE (OHMS)	% READING	NUMBER OF COUNTS					
		100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
30	0.003	215	235	350	55	17	6
300	0.0015	24	25	35	6	4	4
3 K	0.001	5	6	6	4	4	4
30 K	0.001	5	6	6	4	4	4
300 K	0.001	6	7	8	4	4	4
3 M	0.003	12	14	16	7	5	5
30 M	0.02	80	83	93	14	6	4

90 DAY: Tcal ± 5°C
After one hour warm-up.

RANGE (OHMS)	% READING	NUMBER OF COUNTS					
		100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
30	0.0065	315	335	450	65	18	6
300	0.0045	34	35	45	8	4	4
3 K	0.0035	6	7	7	4	4	4
30 K	0.0035	6	7	7	4	4	4
300 K	0.004	7	8	9	4	4	4
3 M	0.0055	12	14	16	7	5	5
30 M	0.025	80	83	93	14	6	5

1 YEAR: Tcal ± 5°C
After one hour warm-up.

RANGE (OHMS)	% READING	NUMBER OF COUNTS					
		100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
30	0.0075	315	335	450	65	18	6
300	0.0055	34	35	45	8	4	4
3 K	0.005	6	7	7	4	4	4
30 K	0.005	6	7	7	4	4	4
300 K	0.005	7	8	9	4	4	4
3 M	0.0065	12	14	16	7	5	5
30 M	0.04	80	83	93	14	6	5

Table 1-1. Specifications

RESISTANCE (Cont'd)

MEASUREMENT ACCURACY - TWO-WIRE OHMS: ±(% of reading + number of counts)
Auto-zero ON.

24 HOUR: Tcal ± 1°C
After two hour warm-up.

RANGE (OHMS)	% READING	NUMBER OF COUNTS					
		100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
30	0.003	20215	20235	20350	20055	20017	20006
300	0.0015	2024	2025	2035	2006	2004	2004
3 K	0.001	205	206	206	204	204	204
30 K	0.001	25	26	26	24	24	24
300 K	0.001	8	9	10	6	6	6
3 M	0.003	12	14	16	7	5	5
30 M	0.02	80	83	93	14	6	4
300 M*	0.6	1000	1000	1000	100	10	1
3 G*	6.0	1000	1000	1000	100	10	1

* Specifications apply for a stable environment (±1°C) and after Ohms Auto-Cal (Auto-Cal 3).

90 DAY: Tcal ± 5°C
After one hour warm-up.

RANGE (OHMS)	% READING	NUMBER OF COUNTS					
		100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
30	0.0065	20315	20335	20450	20065	20018	20006
300	0.0045	2034	2035	2045	2008	2004	2004
3 K	0.0035	206	207	207	204	204	204
30 K	0.0035	26	27	27	24	24	24
300 K	0.004	9	10	11	6	6	6
3 M	0.0055	12	14	16	7	5	5
30 M	0.025	80	83	93	14	6	5
300 M	1.6	1000	1000	1000	100	10	1
3 G	16.0	1000	1000	1000	100	10	1

Table 1-1. Specifications

RESISTANCE (Cont'd)

1 YEAR: Tcal ± 5°C
After one hour warm-up.

RANGE (OHMS)	% READING	NUMBER OF COUNTS					
		100 PLC* 6 1/2 digits	10 PLC* 6 1/2 digits	1 PLC* 6 1/2 digits	.1 PLC* 5 1/2 digits	.005 PLC* 4 1/2 digits	.0005 PLC* 3 1/2 digits
30	0.0075	20315	20335	20450	20065	20018	20006
300	0.0055	2034	2035	2045	2008	2004	2004
3 K	0.005	206	207	207	204	204	204
30 K	0.005	26	27	27	24	24	24
300 K	0.005	9	10	11	6	6	6
3 M	0.0065	12	14	16	7	5	5
30 M	0.04	80	83	93	14	6	5
300 M	1.6	1000	1000	1000	100	10	1
3 G	16.0	1000	1000	1000	100	10	1

* PLC = Integration Time in Power Line Cycles. When using integration times of 100 PLC, 10 PLC, or 1PLC; multiply Number of Counts in the Measurement Accuracy Tables by 0.1 for 5 1/2 digit readings, 0.01 for 4 1/2 digit readings and 0.001 for 3 1/2 digit readings.
Tcal = the temperature of the environment where the 3457A was calibrated. Calibration should be performed with the environment temperature between 18 and 28 degrees centigrade.

TEMPERATURE COEFFICIENT: ±(% of Reading + Number of Counts)/°C
6 1/2 Digits Displayed

RANGE	Auto-Zero ON	Auto-Zero OFF*
30	.0005 + 50	.0005 + 510
300	.0005 + 5.0	.0005 + 60
3 K	.0005 + 0.5	.0005 + 15
30 K	.0005 + 0.5	.0005 + 15
300 K	.0008 + 0.5	.0008 + 15
3 M	.0010 + 0.5	.0010 + 15
30 M	.0025 + 0.5	.0025 + 15
300 M	.3500 + 0.0	.3500 + 10
3 G	3.5000 + 0.0	3.5000 + 10

* Specifications given are for a stable environment (± 1°C) and over a ten minute period. For integration times of >= 1 PLC, multiply Number of Counts by 0.1 for 5 1/2 digit readings, 0.01 for 4 1/2 digit readings and 0.001 for 3 1/2 digit readings.

Table 1-1. Specifications

RESISTANCE (Cont'd)

RANGE (OHMS)	MAXIMUM LEAD RESISTANCE FOUR-WIRE OHMS	MAXIMUM OFFSET VOLTAGE FOR OFFSET COMPENSATED OHMS (FULL SCALE)	PRE-PROGRAMMED SETTLING TIME
30	1 Ohm	1 mV	560 usec
300	10 Ohm	10 mV	350 usec
3 K	100 Ohm	100 mV	350 usec
30 K	1 KOhm	not applicable	350 usec
300 K	10 KOhm	not applicable	2.4 msec
3 M	100 KOhm	not applicable	24 msec
30 M	1 MOhm	not applicable	240 msec
300 M	not applicable	not applicable	2.4 sec
3 G	not applicable	not applicable	2.5 sec

RESPONSE TIME:

First reading meets accuracy specification with pre-programmed settling times and <200 pF circuit capacitance. An additional delay of 0.1 seconds is necessary after a range or function change to meet rated accuracy.

MAXIMUM READING RATES: (Readings/Second)

30 Ohm to 30 KOhm ranges

INTEGRATION TIME	DIGITS DISPLAYED	READING RATE	
		60 HZ	50 Hz
0.0005 PLC	3 1/2	1350	1350
0.005 PLC	4 1/2	1250	1250
0.1 PLC	5 1/2	360	312
1 PLC	6 1/2	53	45
10 PLC	6 1/2	4.8	4.0
100 PLC	6 1/2	.48	.40

Reading Rates apply with the keyboard lock ON, Auto-Zero OFF, Display OFF, Math Function OFF, Delay Time set to 0.0, Manual ranging, readings stored in internal memory using Timer Trigger and single precision integer format.

Table 1-1. Specifications

TRUE RMS AC VOLTAGE
(AC and DC Coupled)

INPUT CHARACTERISTICS:

RANGE	MAXIMUM READING 6 1/2 digits	RESOLUTION 6 1/2 digits	5 1/2 digits	4 1/2 digits	3 1/2 digits
30 mV	32.50000 mV	10 nV	100 nV	1 uV	10 uV
300 mV	325.0000 mV	100 nV	1 uV	10 uV	100 uV
3 V	3.250000 V	1 uV	10 uV	100 uV	1 mV
30 V	32.50000 V	10 uV	100 uV	1 mV	10 mV
300 V	303.0000 V	100 uV	1 mV	10 mV	100 mV

INPUT IMPEDANCE:

1 megohm ±1% shunted by < 90 pF (< 115 pF rear input).

MAXIMUM INPUT VOLTAGE: (non-destructive)

Input Terminals: ± 450V peak.

HI or LO to Earth Ground: ± 450V peak.

CREST FACTOR: 3.5 to 1 at full-scale.

MEASUREMENT ACCURACY - AC COUPLED: ±(% of reading + number of counts)

Specifications apply for sine-wave inputs > 10% of range with DC component < 10% of the AC component, with Auto-zero ON, AC slow filter ON (ACBAND 20), and after 2 hour warm-up.

For AC inputs between 3% and 10% of full-scale and < 20KHz, add 0.7% to the percent of reading figures.

For pre-programmed settling times, add .1% of input voltage step to accuracy specifications for the first reading.

24 HOUR: Tcal ± 1°C (ACV Function) After 2 hour warm-up Accuracy relative to calibration standard 30 mV to 30 V ranges.

FREQUENCY	PERCENT OF READING	NUMBER OF COUNTS >= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	0.5	720	76	12	6
45Hz-100Hz	0.15	720	76	12	6
100Hz-20KHz	0.07	720	76	12	6
** 400Hz-20KHz	0.08	720	510	55	10
20KHz-100KHz	0.6	1700	184	23	7
100KHz-300KHz	3.1	9300	934	98	14
300KHz-1MHz	10.1	66000	6600	664	71

Table 1-1. Specifications

TRUE RMS AC VOLTAGE (Cont'd)

24 HOUR: Tcal ± 1°C (ACV Function) After 2 hour warm-up Accuracy relative to calibration standard
300 V range.

FREQUENCY	PERCENT OF READING	NUMBER OF COUNTS			
		>= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	0.56	720	76	12	6
45Hz-100Hz	0.21	720	76	12	6
100Hz-20KHz	0.13	720	76	12	6
** 400Hz-20KHz	0.14	720	510	55	10
20KHz-100KHz	1.0	3300	334	38	8

90 DAY: Tcal ± 5°C (ACV Function) After 1 hour warm-up
30 mV to 30 V ranges.

FREQUENCY	* PERCENT OF READING	NUMBER OF COUNTS			
		>= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	0.56	1120	116	16	6
45Hz-100Hz	0.21	1120	116	16	6
100Hz-20KHz	0.13	1120	116	16	6
** 400Hz-20KHz	0.14	1120	550	59	10
20KHz-100KHz	0.66	2100	224	27	7
100KHz-300KHz	3.16	9700	974	102	14
300KHz-1MHz	10.16	66400	6640	668	71

90 DAY: Tcal ± 5°C (ACV Function) After 1 hour warm-up
300 V range.

FREQUENCY	* PERCENT OF READING	NUMBER OF COUNTS			
		>= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	0.62	1120	116	16	6
45Hz-100Hz	0.27	1120	116	16	6
100Hz-20KHz	0.19	1120	116	16	6
** 400Hz-20KHz	0.2	1120	550	59	10
20KHz-100KHz	1.06	3700	374	42	8

* Specifications apply within one week of AC auto-cal (ACAL 2) for stable temperature conditions. (Tcal ±5°C). If AC auto-cal is not used, add 0.6 to the percent of reading figures.

** Using AC fast filter (ACBAND 400) for frequencies above 400Hz.

For 1 year specifications, add .1% to 24 hour percent of reading figures, add 600 to 6 1/2 digit counts, add 60 to 5 1/2 digit counts, add 6 to 4 1/2 digit counts, add .6 to 3 1/2 digit counts (Tcal ±5°C).

Table 1-1. Specifications

TRUE RMS AC VOLTAGE (Cont'd)

TEMPERATURE COEFFICIENT - AC COUPLED: All Ranges.

FREQUENCY	PERCENT READING	NUMBER OF COUNTS 6 1/2 digits	5 1/2 digits	4 1/2 digits	3 1/2 digits
* 20Hz-100KHz	0.01	150	15	1.5	0.15
100KHz-1MHz	0.08	300	30	3	0.3

* For AC inputs between 3% and 10% of full-scale and < 20KHz, add .04% to percent reading.

MEASUREMENT ACCURACY - DC COUPLED: ±(% of reading + number of counts)

Accuracy specified for sine-wave inputs > 10% of range with DC component < 10% of the AC component from a source impedance of <10 KOhms, with Auto-zero ON, AC slow filter ON (ACBAND 20), and after 2 hr warm-up. For DC component >10% of the AC component, allow an additional 1.5 sec. settling time for correct first reading, add .14% to the applicable percent of reading figures, add 23000 to the 6 1/2 digit counts, add 2300 to the 5 1/2 digit counts, add 230 to the 4 1/2 digit counts, add 23 to the 3 1/2 digit counts.

For pre-programmed settling times, add .1% of input voltage step to accuracy specifications for the first reading.

24 HOUR: Tcal ± 1°C (ACDCV Function) After 2 hour warm-up Accuracy relative to calibration std
30 mV to 30 V ranges

FREQUENCY	PERCENT OF READING	NUMBER OF COUNTS >= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	1.3	1500	154	20	6
45Hz-100Hz	0.11	1500	154	20	6
100Hz-20KHz	0.11	1500	154	20	6
** 400Hz-20KHz	0.38	1500	2600	264	31
20KHz-100KHz	0.6	2520	256	30	7
100KHz-300KHz	3.1	9300	934	98	14
300KHz-1MHz	10.1	67500	6750	680	72

24 HOUR: Tcal ± 1°C (ACDCV Function) After 2 hour warm-up Accuracy relative to calibration std
300 V range

FREQUENCY	PERCENT OF READING	NUMBER OF COUNTS >= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	1.3	1500	154	20	6
45Hz-100Hz	0.17	1500	154	20	6
100Hz-20KHz	0.17	1500	154	20	6
** 400Hz-20KHz	0.44	1500	2600	264	31
20KHz-100KHz	1.1	4320	440	48	9

Table 1-1. Specifications

TRUE RMS AC VOLTAGE (Cont'd)

90 DAY: Tcal ± 5°C (ACDCV Function) After 1 hour warm-up
30 mV to 300 V ranges

FREQUENCY	* PERCENT OF READING	NUMBER OF COUNTS			
		>= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	1.36	3600	364	41	8
45Hz-100Hz	0.17	3600	364	41	8
100Hz-20KHz	0.17	3600	364	41	8
** 400Hz-20KHz	0.44	3600	2810	285	33
20KHz-100KHz	0.66	4620	466	51	9
100KHz-300KHz	3.16	11400	1144	119	16
300KHz-1MHz	10.16	69600	6960	701	74

90 DAY: Tcal ± 1°C (ACDCV Function) After 1 hour warm-up
300 V range

FREQUENCY	PERCENT OF READING	NUMBER OF COUNTS			
		>= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	1.36	3600	364	41	8
45Hz-100Hz	0.23	3600	364	41	8
100Hz-20KHz	0.23	3600	364	41	8
** 400Hz-20KHz	0.5	3600	2810	285	33
20KHz-100KHz	1.16	6420	650	69	11

* Specifications apply within one week of AC auto-cal (ACAL 2) for stable temperature conditions (Tcal ±5°C). If AC auto-cal is not used, add 0.6 to the percent of reading figures, add 39000 to the 6 1/2 digit counts, add 3900 to the 5 1/2 digit counts, add 390 to the 4 1/2 digit counts and 39 to the 3 1/2 digit counts.

** Using AC fast filter (ACBAND 400) for frequencies above 400Hz.

For 1 year specifications, add .1% to 24 hour percent of reading figures, add 2100 to 6 1/2 digit counts, add 210 to the 5 1/2 digit counts, add 21 to the 4 1/2 digit counts, add 2.1 to the 3 1/2 digit counts.

TEMPERATURE COEFFICIENT - DC COUPLED: 300 mV, 30 V and 300 V ranges.

FREQUENCY	PERCENT READING	NUMBER OF COUNTS			
		6 1/2 digits	5 1/2 digits	4 1/2 digits	3 1/2 digits
20Hz-100KHz	0.01	1000	100	10	1.0
101KHz-1MHz	0.08	1300	130	13	1.3

Table 1-1. Specifications

TRUE RMS AC VOLTAGE (Cont'd)

TEMPERATURE COEFFICIENT - DC COUPLED: 30 mV and 3 V ranges.

FREQUENCY	PERCENT READING	NUMBER OF COUNTS			
		6 1/2 digits	5 1/2 digits	4 1/2 digits	3 1/2 digits
20Hz-100KHz	0.01	5700	570	57	5.7
101KHz-1MHz	0.08	6000	600	60	6.0

COMMON MODE REJECTION:
With 1 KOhm imbalance in LO lead, > 76 db from DC to 60 Hz.

MAXIMUM READING RATES: (Readings/Second)

INTEGRATION TIME	DIGITS DISPLAYED	READING RATE			
		* AC SLOW RESPONSE		* AC FAST RESPONSE	
		60 Hz	50 Hz	60 Hz	50 Hz
0.0005 PLC	3 1/2	1.0	1.0	9.5	9.5
0.005 PLC	4 1/2	1.0	1.0	9.5	9.5
0.1 PLC	5 1/2	1.0	1.0	9.25	9.2
1 PLC	6 1/2	1.0	1.0	7.25	6.9
10 PLC	6 1/2	0.7	0.65	2.0	1.7
100 PLC	6 1/2	0.2	0.17	0.25	0.2

Reading Rates apply with Auto-zero ON, fixed range and preprogrammed settling times.
* ACBAND set to < 400 for AC slow response and set to > 400 for AC fast response.

TRUE RMS AC CURRENT
(AC and DC Coupled)

INPUT CHARACTERISTICS:

RANGE	MAXIMUM READING 6 1/2 digits	RESOLUTION			
		=> 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
30 mA	32.50000 mA	10 nA	100 nA	1 uA	10 uA
300 mA	325.0000 mA	100 nA	1 uA	10 uA	100 uA
1 A	1.000000 A	1 uA	10 uA	100 uA	1 mA

MAXIMUM INPUT: (non-destructive)
1.5 Amps from 250 volt source. Input is fuse protected.

MAXIMUM BURDEN VOLTAGE:
1 Vrms at 1 Arms input for frequencies < 20 KHz.

CREST FACTOR: > 3.5 to 1 at full-scale.

Table 1-1. Specifications

TRUE RMS AC CURRENT (Cont'd)

MEASUREMENT ACCURACY - AC COUPLED: ±(% of reading + number of counts)
After two hour warm-up.
Sine-wave inputs > 10% of range.
AC slow filter ON (ACBAND 20).
Auto-zero ON.
For pre-programmed settling times, error is < 0.1% of input current step.

24 HOUR: Tcal ± 1°C (ACI Function) After 2 hour warm-up Accuracy relative to calibration standard
30 mA and 300 mA ranges.

FREQUENCY	PERCENT OF READING	NUMBER OF COUNTS			
		>= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	0.8	2800	290	32	7
46Hz-100Hz	0.25	2800	290	32	7
101Hz-20KHz	0.2	2800	290	32	7
** 400Hz-20KHz	0.2	2800	750	80	12
21KHz-100KHz	0.9	4000	400	42	8

24 HOUR: Tcal ± 1°C (ACI Function) After 2 hour warm-up Accuracy relative to calibration standard
1 A range. (1 amp maximum input)

FREQUENCY	PERCENT OF READING	NUMBER OF COUNTS			
		>= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	0.9	2800	290	32	7
46Hz-100Hz	0.35	2800	290	32	7
101Hz-20KHz	0.30	2800	290	32	7
** 400Hz-20KHz	0.30	2800	750	80	12

90 DAY: Tcal ± 5°C (ACI Function) After 1 hour warm-up
30 mA and 300 mA ranges.

FREQUENCY	* PERCENT OF READING	NUMBER OF COUNTS			
		>= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	0.85	2800	290	32	7
46Hz-100Hz	0.3	2800	290	32	7
101Hz-20KHz	0.25	2800	290	32	7
** 400Hz-20KHz	0.25	2800	750	80	12
21KHz-100KHz	1.0	4000	400	42	8

Table 1-1. Specifications

TRUE RMS AC CURRENT (Cont'd)

90 DAY: Tcal ± 5°C (ACI Function) After 1 hour warm-up
1 A range. (1 amp maximum input)

FREQUENCY	* PERCENT OF READING	NUMBER OF COUNTS >= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	.95	2800	290	32	7
46Hz-100Hz	0.4	2800	290	32	7
101Hz-20KHz	0.35	2800	290	32	7
** 400Hz-20KHz	0.35	2800	750	80	12

* Specifications apply within one week of AC auto-cal (ACAL 2) for stable temperature conditions. If AC auto-cal is not used, add 0.6 to the percent of reading figures. For 1 year specifications, add .08% to the 90 day Percent of Reading figures.

** Using AC fast filter (ACBAND 400) for frequencies above 400Hz.

TEMPERATURE COEFFICIENT - AC COUPLED: All Ranges.

FREQUENCY	PERCENT READING	NUMBER OF COUNTS 6 1/2 digits	5 1/2 digits	4 1/2 digits	3 1/2 digits
20Hz-100KHz	0.017	150	15	1.5	0.15

MEASUREMENT ACCURACY - DC COUPLED: ±(% of reading + number of counts)
After two hour warm-up.
Sine-wave inputs > 10% of range.
AC slow filter ON (ACBAND 20).
Auto-zero ON.
For pre-programmed settling times, error is 0.1% of input current step.

24 HOUR: Tcal ± 1°C (ACDCI Function) After 2 hour warm-up Accuracy relative to calibration std
30 mA and 300 mA ranges.

FREQUENCY	PERCENT OF READING	NUMBER OF COUNTS >= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	1.5	16000	1600	165	20
46Hz-100Hz	0.35	16000	1600	165	20
101Hz-20KHz	0.25	16000	1600	165	20
** 400Hz-20KHz	0.6	16000	3750	375	42
21KHz-100KHz	0.9	17500	1750	180	22

Table 1-1. Specifications

TRUE RMS AC CURRENT (Cont'd)

24 HOUR: Tcal ± 1°C (ACDCI Function) After 2 hour warm-up Accuracy relative to calibration std
1 A range. (1 amp maximum input)

FREQUENCY	PERCENT OF READING	NUMBER OF COUNTS			
		>= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	1.6	16000	1600	165	20
46Hz-100Hz	0.45	16000	1600	165	20
101Hz-20KHz	0.35	16000	1600	165	20
** 400Hz-20KHz	0.7	16000	3750	375	42

90 DAY: Tcal ± 5°C (ACDCI Function) After 1 hour warm-up
30 mA and 300 mA ranges.

FREQUENCY	* PERCENT OF READING	NUMBER OF COUNTS			
		>= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	1.55	16000	1600	165	20
46Hz-100Hz	0.4	16000	1600	165	20
101Hz-20KHz	0.3	16000	1600	165	20
** 400Hz-20KHz	0.65	16000	3750	375	42
21KHz-100KHz	0.95	17500	1750	180	22

90 DAY: Tcal ± 1°C (ACDCI Function) After 1 hour warm-up
1 A range. (1 amp maximum input)

FREQUENCY	* PERCENT OF READING	NUMBER OF COUNTS			
		>= 1 PLC 6 1/2 digits	0.1 PLC 5 1/2 digits	.005 PLC 4 1/2 digits	.0005 PLC 3 1/2 digits
20Hz-45Hz	1.65	16000	1600	165	20
46Hz-100Hz	0.5	16000	1600	165	20
101Hz-20KHz	0.4	16000	1600	165	20
** 400Hz-20KHz	0.75	16000	3750	375	42

* Specifications apply within one week of AC auto-cal (ACAL 2) for stable temperature conditions. If AC auto-cal is not used, add 0.6 to the percent of reading figures, add 6000 to the 6 1/2 digit counts, add 600 to the 5 1/2 digit counts, add 60 to the 4 1/2 digit counts and 6 to the 3 1/2 digit counts.
For 1 year specifications, add .08% to the 90 day Percent of Reading figures.

** Using AC fast filter (ACBAND 400) for frequencies above 400Hz.

Table 1-1. Specifications

TRUE RMS AC CURRENT (Cont'd)

TEMPERATURE COEFFICIENT - DC COUPLED: All Ranges.

FREQUENCY	PERCENT READING	NUMBER OF COUNTS 6 1/2 digits	5 1/2 digits	4 1/2 digits	3 1/2 digits
20Hz-100KHz	0.017	1500	150	15	1.5

MAXIMUM READING RATES: (Readings/Second)

INTEGRATION TIME	DIGITS DISPLAYED	READING RATE * AC SLOW RESPONSE 60 Hz	 50 Hz	 * AC FAST RESPONSE 60 Hz	 50 Hz
0.0005 PLC	3 1/2	1.0	1.0	9.5	9.5
0.005 PLC	4 1/2	1.0	1.0	9.5	9.5
0.1 PLC	5 1/2	1.0	1.0	9.25	9.2
1 PLC	6 1/2	1.0	1.0	7.25	6.9
10 PLC	6 1/2	0.7	0.65	2.0	1.7
100 PLC	6 1/2	0.2	0.17	0.25	0.2

Reading Rates apply with Auto-zero ON, fixed range and preprogrammed settling times.

* ACBAND set to < 400 for AC slow response and set to > 400 for AC fast response.

FREQUENCY AND PERIOD

Measures the frequency or period of the ac component of ac or dc coupled voltage or current. The counter uses a reciprocal counting technique to provide constant resolution independent of the input frequency.

INPUT IMPEDANCE:

1 megohm shunted by < 90 picofarads.

MAXIMUM INPUTS:

Voltage:

Input Terminals - ± 450V peak.

HI or LO to Earth Ground - ± 450V peak.

Current:

1.5 amps from 250 volt source. Input is fuse protected.

FREQUENCY RANGE:

Voltage Function - 10Hz to 1.5MHz

Current Function - 10Hz to 100KHz

PERIOD RANGE:

Voltage Function - 100msec to 667nsec

Current Function - 100msec to 10usec

Table 1-1. Specifications

FREQUENCY AND PERIOD (Cont'd)

SENSITIVITY:
10mV rms or 100uA rms sine-wave

TRIGGERING:
Triggers and counts on zero crossings.

MEASUREMENT ACCURACY: ±(% of reading)

FREQUENCY	PERIOD	% OF READING
10Hz - 400Hz	100msec - 2.5msec	0.05
400Hz - 1.5MHz	2.5msec - 667nsec	0.01

MAXIMUM READING RATE:
2 readings/second (Integration time of 1 PLC, fast settling time, delay zero and math OFF, and fixed range)

PLUG-IN OPTION
44491A Armature Relay Multiplexer Assembly

INPUT CHARACTERISTICS:
Eight two-wire armature relay channels and two current/actuator channels.

MAXIMUM VOLTAGE: (Terminal to Terminal or Terminal to Chassis)
250 VDC or 250 VAC rms

MAXIMUM CURRENT: (per channel)
1 amp DC or AC rms

THERMAL OFFSET:
< 3 microvolts

RELAY LIFE:
10^7 operations at maximum load (1.5 amps AC rms).

CLOSED CHANNEL RESISTANCE: (end of relay life)
< 2 ohms

MAXIMUM SWITCHING AND MEASUREMENT SPEED:
33 channels/second

ADJACENT CHANNEL CROSSTALK: (Channels terminated into 50 ohms)
-60 db @ 100KHz

Table 1-1. Specifications

PLUG-IN OPTION
44491A Armature Relay Multiplexer Assembly (Cont'd)

DC ISOLATION:
Channels 0 - 7 (40°C, 95% Relative Humidity) 10^{10} Ohms
Channels 8 and 9 (40°C, 95% Relative Humidity) 10^{9} Ohms
Channels 0 - 7 (40°C, 60% Relative Humidity) 10^{11} Ohms
Channels 8 and 9 (40°C, 60% Relative Humidity) 10^{10} Ohms

AC ISOLATION:
Channels 0 - 7 Closed: 150 pF
Channels 0 - 7 Open: 10 pF
LO to Chassis: 420 pF

PLUG-IN OPTION
44492A Reed Relay Multiplexer Assembly

INPUT CHARACTERISTICS:
Ten two-wire reed relay channels.

MAXIMUM VOLTAGE: (Terminal to Terminal or Terminal to Chassis)
125 volts peak to peak.

THERMAL OFFSET:
3 microvolts.

RELAY LIFE:
10^{7} operations at maximum load (125 VAC peak to peak).

CLOSED CHANNEL RESISTANCE: (end of relay life)
< 4 ohms

MAXIMUM SWITCHING AND MEASUREMENT SPEED:
300 channels/second

ADJACENT CHANNEL CROSSTALK: (Channels terminated into 50 ohms)
-40 db @ 100KHz

DC ISOLATION:
Channels 0 - 9 (40°C, Relative Humidity 95%) 10^{9} Ohms
Channels 0 - 9 (40°C, 60% Relative Humidity) 10^{10} Ohms

AC ISOLATION:
Channels 0 - 9 Closed: 200 pF
Channels 0 - 9 Open: 15 pF
LO to Chassis: 420 pF

44492A operation is not specified for the 30 Ohm range or for frequencies above 100 KHz.

Table 1-1. Specifications

GENERAL

OPERATING TEMPERATURE:
0° to 55° C

STORAGE TEMPERATURE:
-40° to +75° C

WARM-UP TIME:
One hour to meet all specifications, except where noted.

HUMIDITY RANGE:
95% relative humidity for temperatures between 0° and 40° C.

POWER REQUIREMENTS:
100/120/240 volts ±10%, 48Hz to 66Hz. 30 VA maximum.

DIMENSIONS:
Height - 89mm (3.5 ") (With feet removed), 100mm (4 ") (With feet)
Width - 425mm (16.75 ")
Depth - 292mm (11.5 ")
Allow 76mm (3 ") additional depth for wiring.

NET WEIGHT:
5.05 kgm (11.1 lbs)

SHIPPING WEIGHT:
9.3 kgm (20.5 lbs)

1-15. OPTIONS AND ACCESSORIES

1-16. Table 1-2. lists the options and accessories available for the HP 3457A Digital Multimeter:

Table 1-2. Available Options and Accessories

OPTION NUMBER Use this number when ordering with the HP 3457A	ACCESSORY NO. Use this number when ordering separately	DESCRIPTION of Option or Accessory
HP 44491A	HP 44491A	General Purpose Plug-in Assembly
HP 44492A	HP 44492A	10 Channel Multiplexer Assembly
HP 44493A	HP 44493A	Extra Wiring Block for 44491A
HP 44494A	HP 44494A	Extra Wiring Block for 44492A
Option 401	5061-1171	Side Handle Kit
Option 907	5061-1170	Front Handle Kit
Option 908	5061-1168	Rack Mount Kit
Option 909	5061-1169	Rack Mount with Front Handle
Option 910	Order by Part No.	Additional Set of 3457A Manuals
Option W30		2 Additional years of Return to HP hardware support
10833A	10833A	HP-IB Cable 1.0 meter (39.37 in)
10833B	10833B	HP-IB Cable 2.0 meter (78.74 in)
10833C	10833C	HP-IB Cable 4.0 meter (157.5 in)
10833D	10833D	HP-IB Cable 0.5 meter (19.69 in)
34118	34118	Test Lead Kit
11096B	11096B	RF Probe (700MHz)
34111A	34111A	High Voltage Probe (40KVdc)
HP 44414A	HP 44414A	Pack of 4 Thermistors
03457-10085	03457-10085	Calibration Software for HP 85B
03457-10200	03457-10200	Calibration Software for HP 200

1-17. TEST EQUIPMENT

1-18. Table 1-3 lists requirements for service equipment necessary to calibrate and repair the Model HP 3457A.

Table 1-3. Test Equipment Requirements

INSTRUMENT	CRITICAL SPECIFICATIONS	SUGGESTED MODEL	USE
DC VOLTAGE SOURCE	30mV ±.0055%, 300mV ±.0012% 1V, 2V & 3V ±.0006%, 30V ±.0013%, 300V ±.0017%	Datron Model 4000A	PAT
DC CURRENT SOURCE	300uA, 3mA & 30mA ±.007% 300mA ±.026%, 1A ±.04%	Datron Model 4000A	PAT
AC VOLTAGE SOURCE	1MHz - 30mVrms ±10%, 300mVrms & 3Vrms ±3% 300KHz - 30mVrms ±2%, 300mVrms & 3Vrms ±1% 100KHz - 30mVrms ±.6%, 300mVrms & 3Vrms ±.2% 20KHz - 30mVrms ±.3%, 300mVrms & 3Vrms ±.2% 6.5KHz - 30mVrms ±.3%, 300mVrms & 3Vrms ±.2% 1KHz - 30mVrms, 300mVrms, 1Vrms, 2Vrms, 3Vrms, 30Vrms & 300Vrms ±.1% 400Hz - 30mVrms ±.3%, 300mVrms & 3Vrms ±.2% 100Hz - 300mVrms & 3Vrms ±.1% 45Hz - 300mVrms & 3Vrms ±.3% 20Hz - 300mVrms & 3Vrms ±.3%	Datron Model 4200	PAT
AC CURRENT SOURCE	1KHz -30mA & 300mA ±.14%, 1A ±.24%	Datron Model 4200	PAT
RESISTANCE STANDARD	30ohms ±.004%, 300ohms ±.002%, 3Kohms ±.001% 30Kohm, 300Kohm & 3Mohm ±.001%, 30Mohm ±.009%	Datron Model 4000A	PAT
FREQUENCY SOURCE	20Hz ±.016%, 1MHz ±.003%	Datron Model 4200 or HP Model 3325A	PAT
FREQUENCY COUNTER	5Hz to 1.5MHz ±.003%	HP Model 3457A or HP Model 5314A	PAT
DIGITAL MULTIMETER		HP Model 3456A or HP Model 3457A	PAT
OSCILLOSCOPE		HP Model 1740A	T

P = Performance Test A = Adjustment T = Troubleshooting

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section contains information to aid in the installation and interfacing of the HP 3457A Digital Multimeter. This section also includes initial inspection procedures, power requirements, environmental information, and instructions for repackaging the instrument for shipment. The information contained in this section is for service trained personnel.

WARNING

The information contained in this manual is for service trained personnel who are familiar with electronic circuitry and understand the hazards involved. To avoid electrical shock or damage to the instrument, do not perform any procedures in this manual or do any servicing to the instrument unless you are qualified to do so.

2-3. INITIAL INSPECTION

2-4. The 3457A was carefully inspected, both mechanically and electrically, before shipment. It should be free of mars or scratches and in perfect electrical order upon receipt. The instrument should be carefully inspected for any damage which may have occurred during transit. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been mechanically and electrically inspected. The contents of the shipment should be as shown in Figure 2-1; procedures for testing the electrical performance of the HP 3457A are contained in Section IV of this manual. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the performance tests, notify the nearest Hewlett-Packard office (a list of HP Sales and Service offices is located in the back of this manual). If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Save the shipping material for the carrier's inspection.

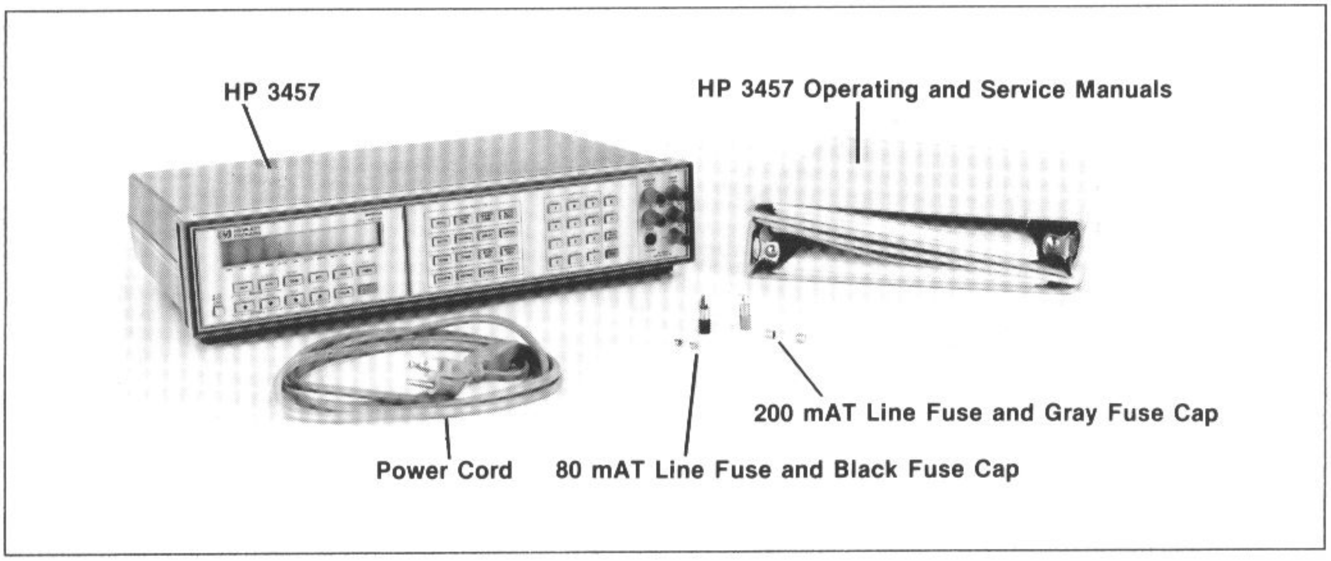
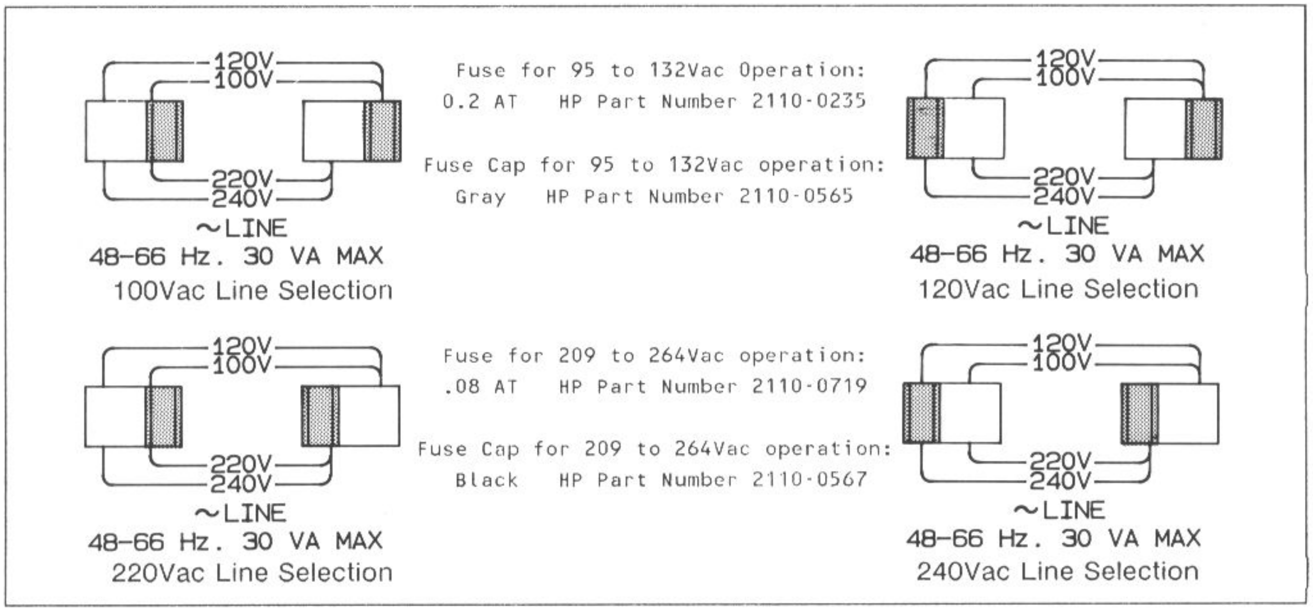

HP 3457
HP 3457 Operating and Service Manuals
200 mAT Line Fuse and Gray Fuse Cap
Power Cord
80 mAT Line Fuse and Black Fuse Cap

Figure 2-1. Shipment Contents



100Vac Line Selection

120Vac Line Selection

220Vac Line Selection

240Vac Line Selection

Fuse for 95 to 132Vac Operation:
0.2 AT HP Part Number 2110-0235

Fuse Cap for 95 to 132Vac operation:
Gray HP Part Number 2110-0565

Fuse for 209 to 264Vac operation:
.08 AT HP Part Number 2110-0719

Fuse Cap for 209 to 264Vac operation:
Black HP Part Number 2110-0567

Figure 2-2. Line Voltage and Fuse Selection

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. The HP 3457A requires a power source of 100, 120, 220, or 240 Vac (+5%, -10%), 48Hz to 66Hz single phase. Power consumption is less than 30VA.

CAUTION

Before connecting power to the HP 3457A, make certain that the line selection switches (located on the rear panel) have been set to accept the available power source and that the proper fuse is installed.

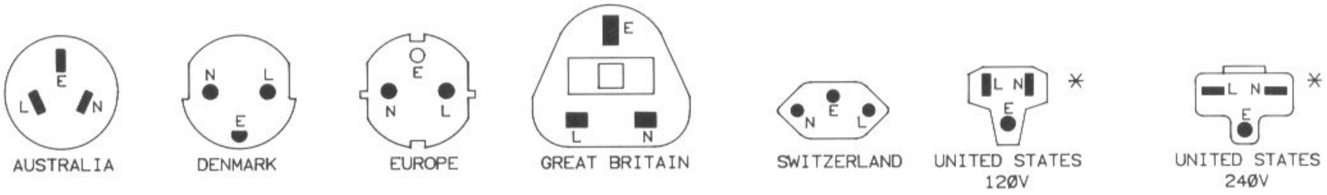
2-8. Line Voltage Selection

2-9. The line voltage selection switches are located on the rear panel below the power connector and fuse. Figure 2-2 shows the appropriate switch positions and fuse requirements for the various power line voltages.

2-10. Power Cords

2-11. This instrument is equipped with a three-wire power cable. This cable, when connected to an appropriate ac power receptacle, grounds the metal parts of the cabinet. The type of plug supplied with the power cable depends upon the country of destination. Figure 2-3 illustrates the power plugs available. The HP Part Number listed below each figure is the part number for the complete power cord assembly. If the appropriate power cord is not supplied with your instrument, notify your nearest HP Sales and Service Office and a replacement cable will be supplied.

POWER CORDS



Country	Part Number	Opt.	Voltage
Australia	8120-1369	901	250V 6A
Denmark	8120-2956	912	250V 6A
Europe	8120-1689	902	250V 6A
Great Britain	8120-1351	900	250V 6A
Switzerland	8120-2104	906	250V 6A
*United States	8120-1378	903	120V 10A
*United States	8120-0698	904	240V 10A

Power cords supplied by HP have polarities matched to the power input socket on the instrument:

- L = Line or Active Conductor (also called "live" or "hot").
- N = Neutral or Identified Conductor
- E = Earth or Safety Ground

NOTE: Plugs are viewed from connector end. Shape of molded plug may vary within country.

* CSA certification includes only these Power Plugs

Figure 2-3. Power Cables

2-12. Grounding Requirements

2-13. To protect operating personnel from shock hazard, the National Electrical Manufacturer's Association (NEMA) recommends grounding the instrument cabinet. The *-hp-* 3457A is equipped with a three conductor power cord which, when connected to an appropriate outlet, grounds the metal portions of the cabinet.

2-14. Bench Use

2-15. The *-hp-* Model 3457A is shipped with feet and tilt stands installed and is ready for use as a bench instrument. The feet are shaped to permit stacking with other *-hp-* full-module instruments.

2-16. Rack Mounting

2-17. The *-hp-* 3457A may be rack mounted by adding rack mounting kit Option 908 when ordering the instrument. The rack mounting kit may also be ordered separately by ordering *-hp-* Part Number 5061-1168. The basic hardware and instructions for rack mounting is contained in the kit. The rack mounting hardware is designed to permit the 3457A to be mounted in a standard 19 inch rack, provided that sufficient rear support is available. Refer to Section 1 for other mounting options.

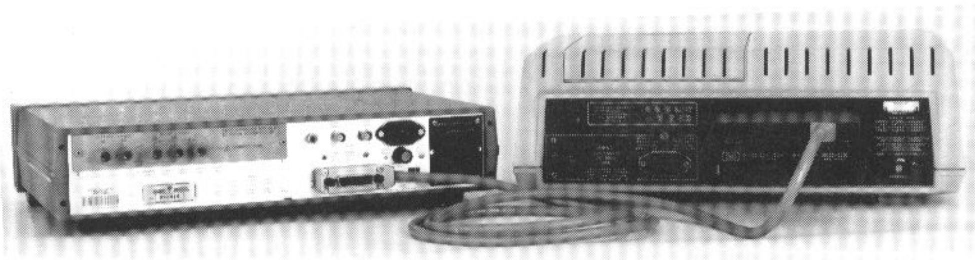


Figure 2-4. Typical HP-IB Interface Connection

2-18 INTERFACE CONNECTIONS

2-19. Control Interface

2-20. The HP Model 3457A is compatible with the Hewlett-Packard Interface Bus (HP-IB). Connection is made using an HP-IB interface cable to connect the controller to the appropriate connector on the rear of the HP 3457A. A typical HP-IB interface system is shown in Figure 2-4. The system shown uses three HP-IB interface cables to connect the instruments in the system. Each interface connector is both a male and female connector to permit connection to an instrument and another interface cable. As many as 15 instruments can be connected by the same interface bus. However, the maximum length of cable used to connect a group of instruments should not exceed the number of instruments times 2 meters (6.56 ft.), or a maximum of 20 meters (65.6 ft.), whichever is less. Refer to Figure 2-5 for a pictorial view of the HP-IB connector and its pin designations.

NOTE

HP-IB is Hewlett-Packard's implementation of IEEE Std. 488-1978, "Standard Digital Interface for Programmable Instrumentation".

2-21. HP-IB ADDRESS SELECTION

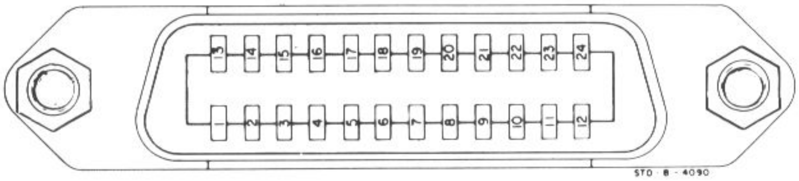
2-22. The HP-IB address is programmed from the front panel or over the interface bus. The address is set to decimal "22" at the factory. This corresponds to an ASCII listen address of "6" and talk address of "V". The HP 3457A display momentarily shows the current address code whenever the instrument is turned on or reset.

NOTE

When choosing an address, be certain it is unique to the system involved. Some controllers have an HP-IB address. As an example: HP Series 200 computers have an address of decimal 21.

PIN	LINE
1	DI01
2	DI02
3	DI03
4	DI04
13	DI05
14	DI06
15	DI07
16	DI08
5	EOI
17	REN
6	DAV
7	NRFD
8	NDAC
9	IFC
10	SRQ
11	ATN
12	SHIELD–CHASSIS GROUND
18	P/O TWISTED PAIR WITH PIN 6
19	P/O TWISTED PAIR WITH PIN 7
20	P/O TWISTED PAIR WITH PIN 8
21	P/O TWISTED PAIR WITH PIN 9
22	P/O TWISTED PAIR WITH PIN 10
23	P/O TWISTED PAIR WITH PIN 11
24	ISOLATED DIGITAL GROUND

THESE PINS ARE INTERNALLY GROUNDED



CAUTION

The HP 3457A contains metric threaded HP-IB cable mounting studs as opposed to English threads. Metric threaded HP 16031A, B, or C HP-IB cable lockscrews must be used to secure the cable to the instrument. Identification of the two types of mounting studs and lockscrews is made by their color. English threaded fasteners are colored silver and metric threaded fasteners are colored black. DO NOT mate silver and black fasteners to each other or the threads of either or both will be destroyed. Metric threaded HP-IB cable hardware illustrations and part numbers follow.

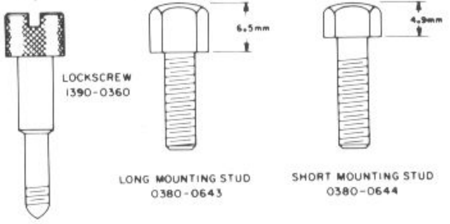


Figure 2-5. HP-IB Connector

2-23. Changing the Address from the Front Panel. The HP-IB address code is set from the front panel as follows:

a. Select the Command Directory "A" listing by pressing the BLUE shift key, then the Configuration "A" key (the display will show ACAL).

b. Use the ↓ scroll key to advance the command listing to ADDRESS.

c. Enter the desired HP-IB decimal address using the MATH keys (refer to Figure 2-6 for a list of available codes).

d. Press the ENTer key located at the lower-right corner of the keyboard.

e. To check the new address, press the BLUE shift key then then the LOCAL/ADRS key. The display will show the new address code. Press any key to stop display of the address.

2-24. Changing the Address from the Controller. To change the HP-IB address from the controller, proceed as follows:

a. Determine the present device address of the HP 3457A. (The address must be known in order to communicate with the HP 3457A.) The address is momentarily displayed during the power-on sequence or can be called by pressing the BLUE shift key then the LOCAL/ADRS key.

ASCII CODE CHARACTER			ASCII CODE CHARACTER		
Listen	Talk	Decimal Code	Listen	Talk	Decimal Code
SP	@	00	0	P	16
!	A	01	1	Q	17
"	B	02	2	R	18
#	C	03	3	S	19
$	D	04	4	T	20
%	E	05	5	U	21
&	F	06	6	V	22
'	G	07	7	W	23
(	H	08	8	X	24
)	I	09	9	Y	25
*	J	10	:	Z	26
+	K	11	;	[	27
,	L	12	<	\	28
-	M	13	=	]	29
.	N	14	>	~	30
/	O	15	Talk Only		31*

* Address 31 sets the 3457A to the Talk Only Mode. In this mode, the 3457A will output directly to an HP-IB printer without a controller on the bus. Address 31 is not, however, a valid HP-IB address with a controller on the bus.

Figure 2-6. HP-IB Address Codes

b. Transmit the new device address to the HP 3457A. The message required to transmit the new address code consists of the controller's transmit command, the HP-IB interface select code, the HP 3457A's device address and the message. As an example; typing the following into a controller which uses HP-enhanced BASIC, would change the device address of the HP 3457A from "22" to "18".

```
OUTPUT 722; "ADDRESS18"
```

In this command statement, OUTPUT is the transmit command of the controller used; "7" is the select code of the HP-IB interface; "22" is the present address of the HP 3457A and "ADDRESS18" is the message to change the instrument address to 18.

2-25. INSTALLATION OF OPTIONS

2-26. The HP 3457A is shipped from the factory with the Rear Terminal Assembly installed. Optional Plug-In Assemblies are packaged separately and must be configured and installed by the customer. Each Plug-In Assembly includes a wiring block and two-piece strain relief housing for making external connections.

2-27. The following paragraphs provide information necessary to configure and install Optional Plug-In Assemblies HP 44491A or HP 44492A.

WARNING

To prevent personal injury, disconnect all external input connections to the HP 3457A before removing or installing the Rear Terminal Assembly or Optional Plug-In Assembly.

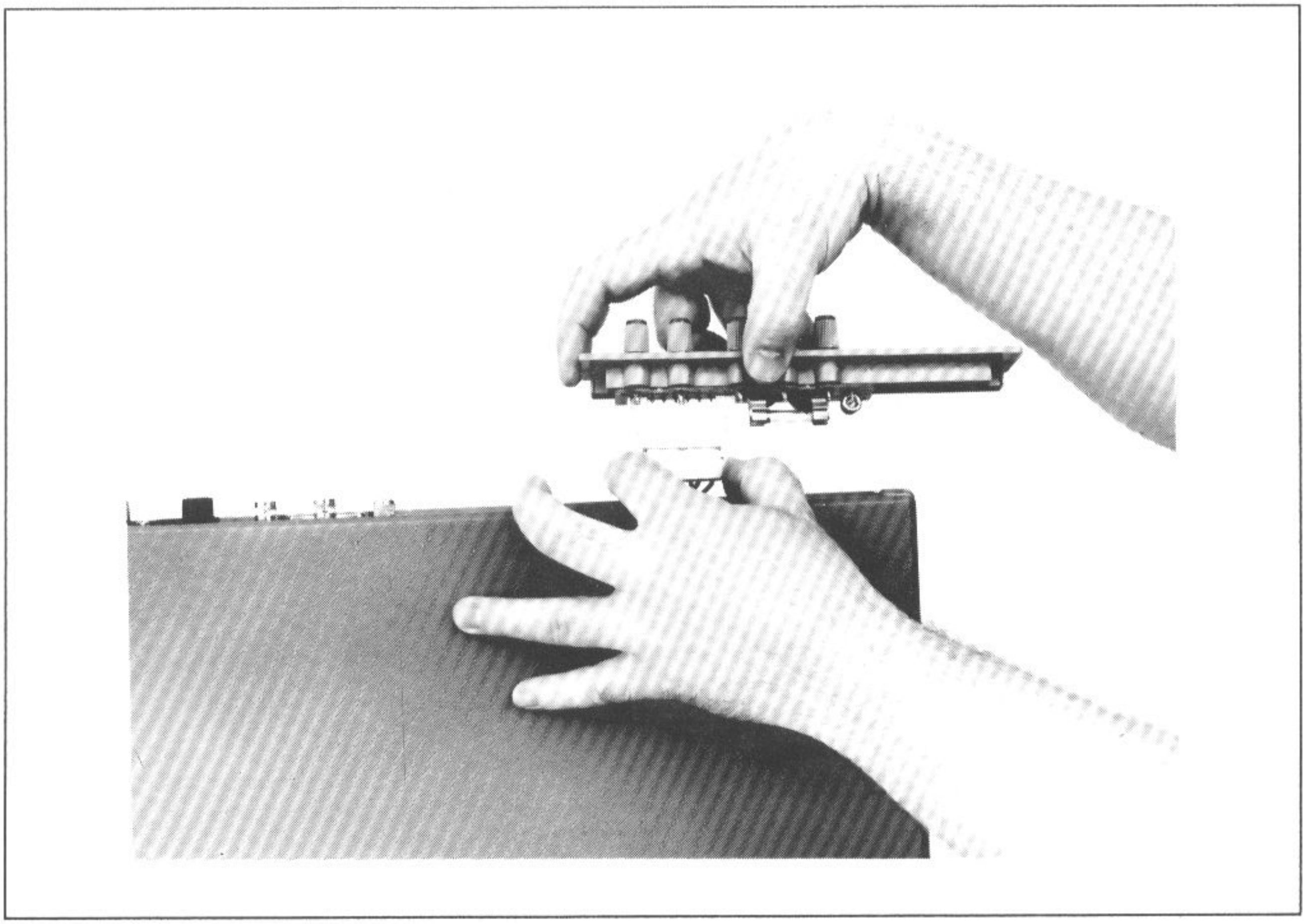


Figure 2-7. Rear Terminal Assembly Removal

CAUTION

Use clean handling and anti-static techniques when removing, configuring, and installing a Plug-In Assembly. The circuit boards must be kept clean to ensure compliance with impedance specifications. The Plug-In Assemblies as well as the HP 3457A mainframe contain CMOS devices that are susceptible to damage from static electricity.

2-28. Rear Terminal Assembly Removal

2-29. The Rear Terminal Assembly must be removed before an Optional Plug-In Assembly can be installed. Remove the Rear Terminal Assembly as follows:

a. Remove the power cord and all external input connections from the HP 3457A.

b. Remove the two screws attaching the Terminal Assembly to the rear panel.

c. Remove the Terminal Assembly and disconnect the attached connector.

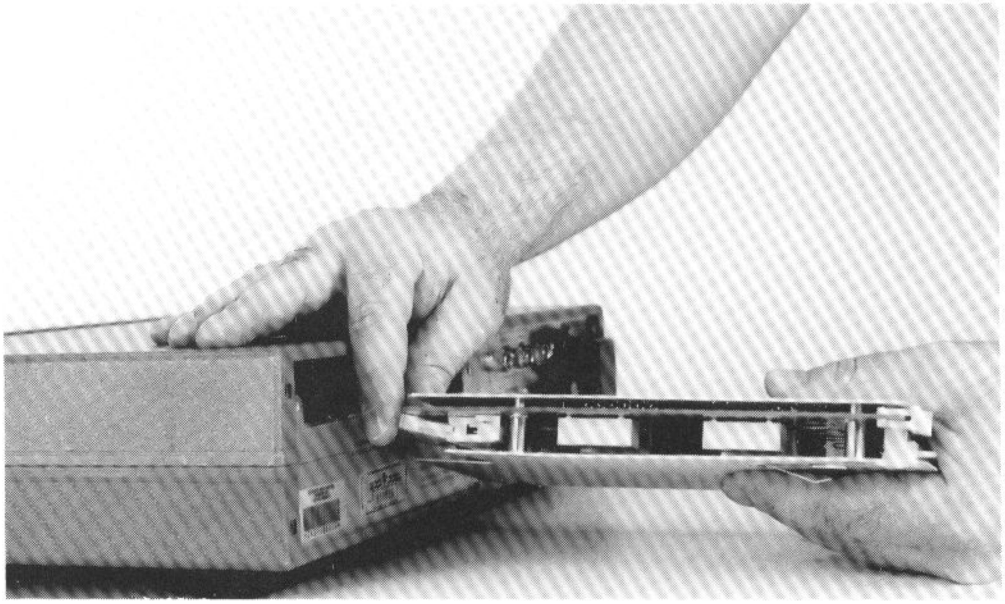


Figure 2-8. Connecting the Wiring Harness

2-30. Plug-In Assembly Installation

2-31. The Rear Terminal Assembly must be removed, as described in paragraph 2-28, before installing a Plug-In Assembly. Install the Plug-In Assembly as follows:

a. Connect the HP 3457A wiring harness connector to the Plug-In Assembly connector as shown in Figure 2-8.

b. Open the two white locking tabs by pulling them away from the circuit board. Notice that each locking tab has a detent which tends to hold it in the closed position.

c. Position the Plug-In Assembly with the component side of the printed circuit board facing down. Slide the Plug-In Assembly into the guides in the rear of the HP 3457A. Firmly push the assembly into the HP 3457A until it stops.

d. Close the two white locking tabs by pressing them flat against the circuit board. As the locking tabs are closed, the Plug-In Assembly is is pushed into the slot. This action locks the assembly into place and engages the assembly's connector with the connector in the HP 3457A.

e. Calibrate the Plug-In Assembly using the appropriate procedure in Section V of this manual.

NOTE

To remove the Plug-In Assembly, simply open the white locking tabs. This releases the locking mechanism and pulls the assembly out of the mainframe connector.

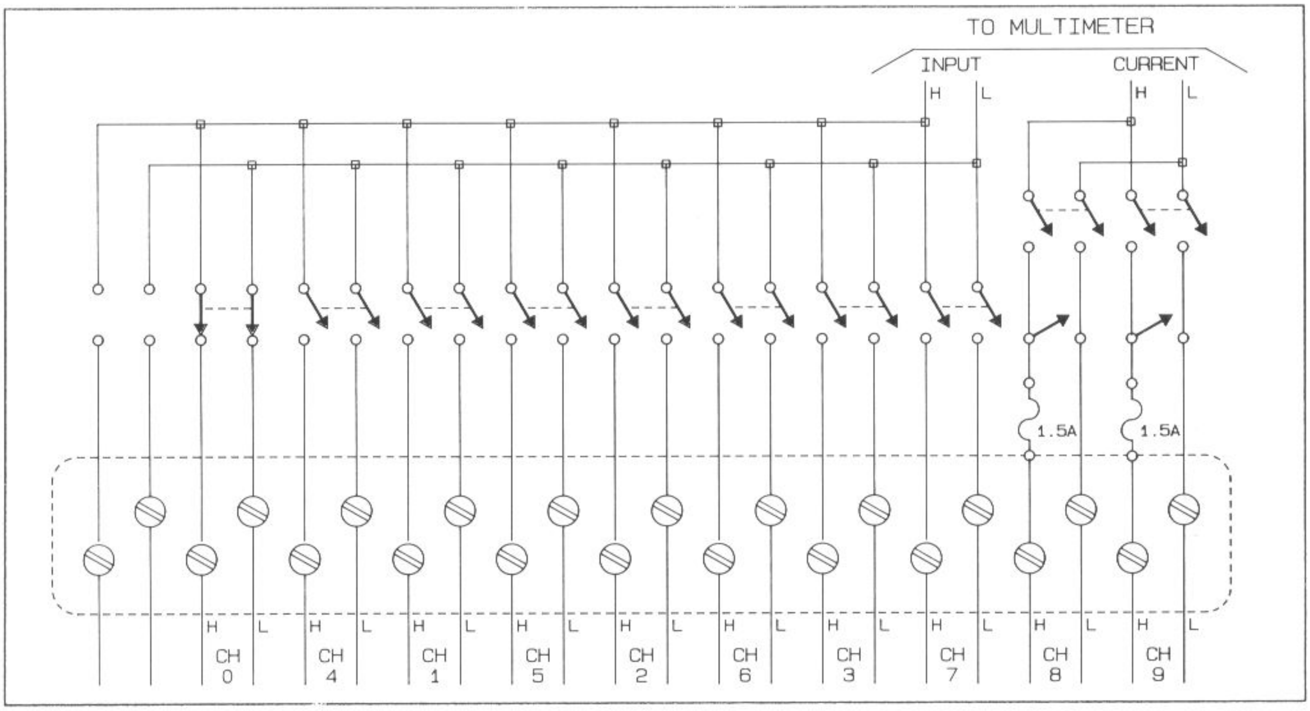


Figure 2-9. HP 44491A 2-Wire Input Configuration

2-32. Plug-In Assembly Configuration

2-33. The Wiring Block Assembly configuration is dependent upon the particular Plug-In Assembly installed (HP 44491A or HP 44492A) and the user's application.

2-34. HP 44491A Configuration. The HP 44491A Armature Relay Assembly can be configured for eight 2-wire input channels, four 4-wire input channels or a combination of 2 and 4-wire input channels. The assembly also has two 2-wire input channels which are used for measuring current or as actuator outputs. The Wiring Block Assembly must be wired for the particular configuration used.

WARNING

The HP 44491A Armature Relay Assembly uses latching relays. The state of these relays can only be altered under program control. This is an advantage in the sense that, under most conditions of failure, the relays will remain in whatever state the program has set them. However, in case of a power failure, any application requiring a fail-safe method of ensuring that the circuits under control are in a known state must be provided by the installer.

In case of component failure or programming error, any voltage input to a plug-in assembly may be present on any other terminal of the plug-in assembly.

2-35. Figures 2-9 through 2-11 show simplified schematics of the HP 44491A Armature Relay Multiplexer Assembly configured for 2-wire inputs, 4-wire inputs and current/actuator applications.

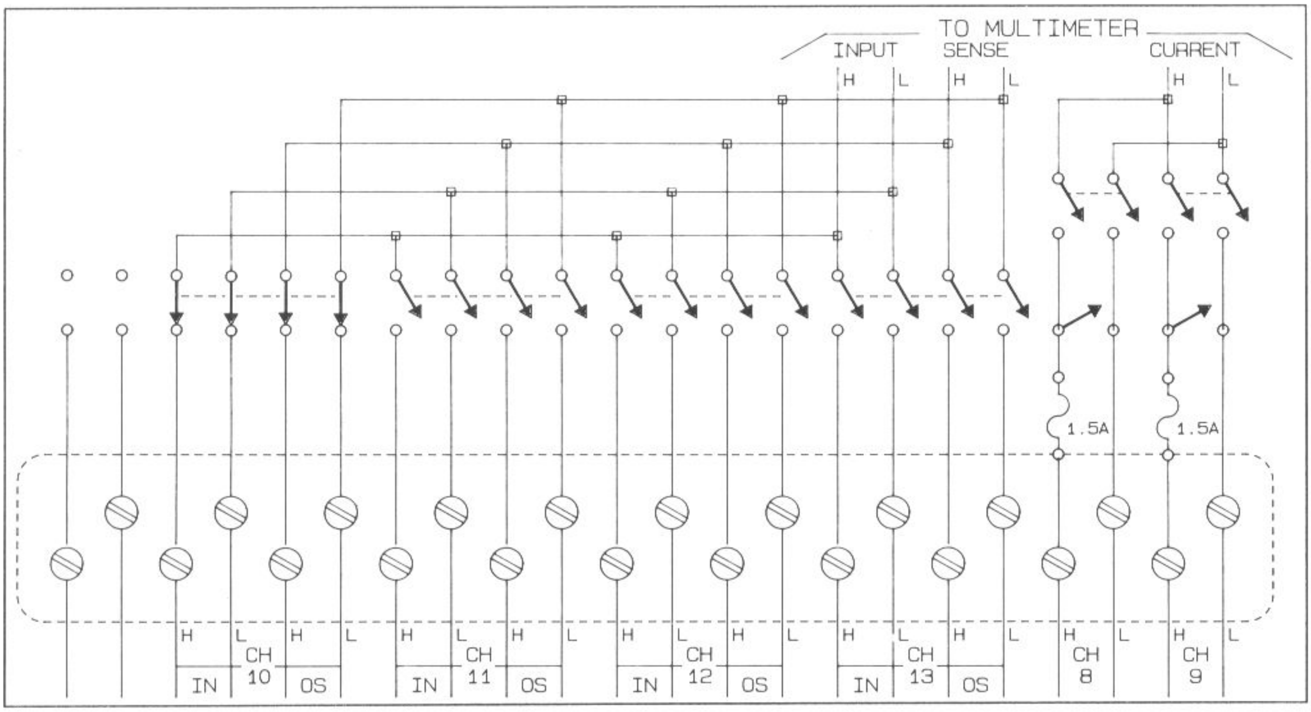

TO MULTIMETER
INPUT
SENSE
CURRENT
H
L
H
L
H
L
1.5A
1.5A
H L H L
CH 10
IN
OS
H L H L
CH 11
IN
OS
H L H L
CH 12
IN
OS
H L H L
CH 13
IN
OS
H L
CH 8
H L
CH 9

Figure 2-10. HP 44491A 4-Wire Input Configuration

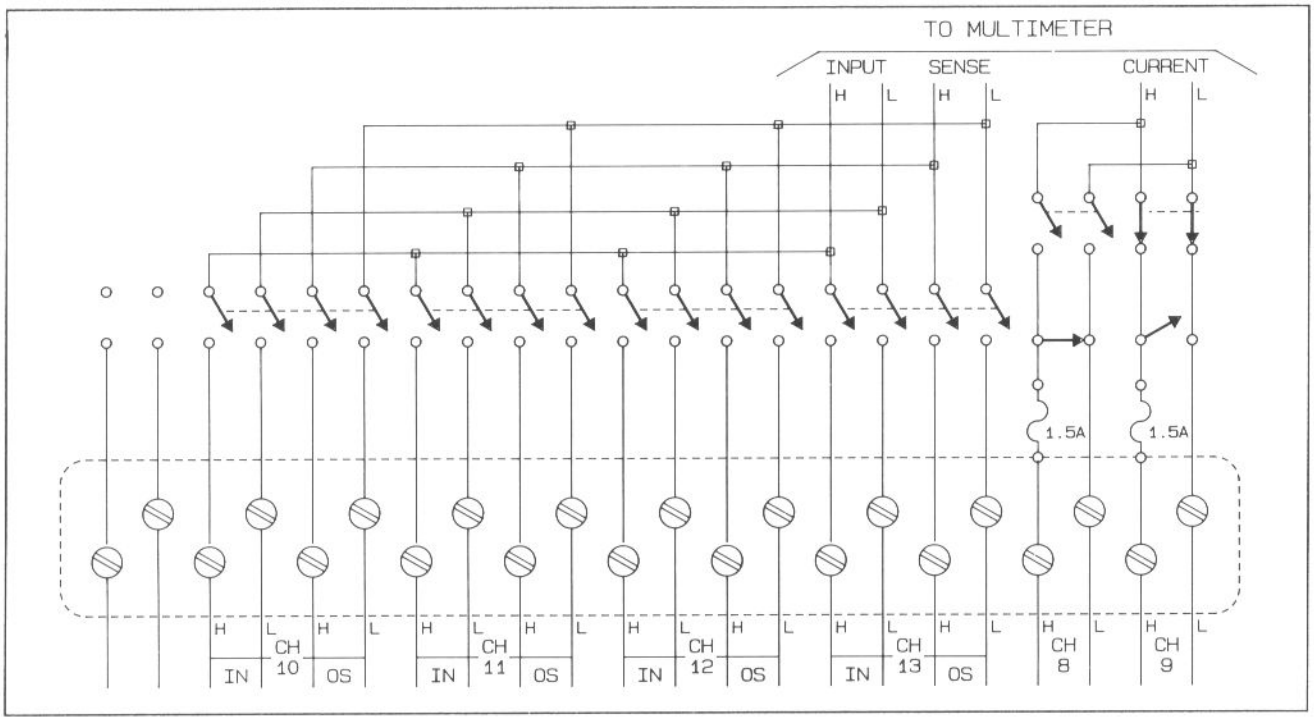

TO MULTIMETER
INPUT
SENSE
CURRENT
H
L
H
L
H
L
1.5A
1.5A
H L H L
CH 10
IN
OS
H L H L
CH 11
IN
OS
H L H L
CH 12
IN
OS
H L H L
CH 13
IN
OS
H L
CH 8
H L
CH 9

Figure 2-11. HP 44491A Current/Actuator Configuration

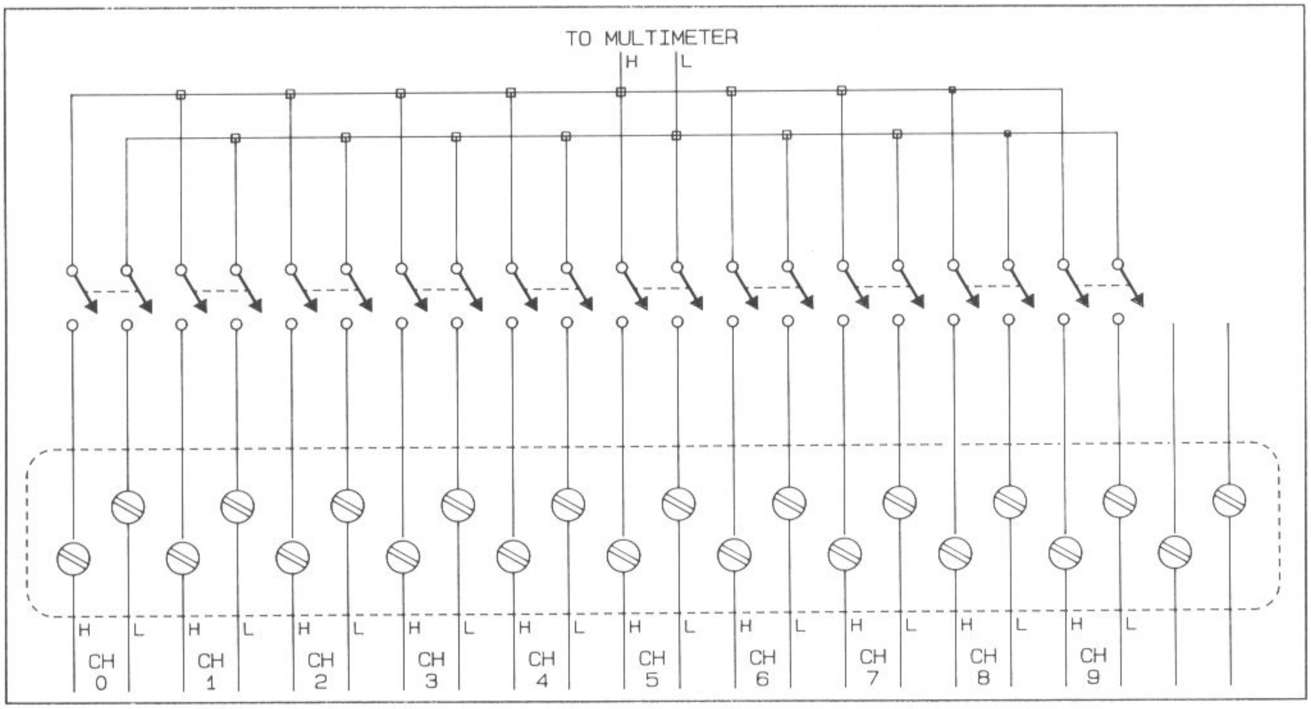


Figure 2-12. HP 44492A Simplified Schematic

2-36. HP 44492A Configuration. The HP 44492A Reed Relay Multiplexer Assembly can be configured for ten 2-wire input measurements. It can be used to measure dc voltage, ac voltage, ac + dc voltage, resistance, frequency and period. It cannot be used for 4-wire ohms or current measurements.

2-37. Figure 2-12 shows a simplified schematic of the HP 44492A Reed Relay Multiplexer Assembly.

2-38. Wiring Block Preparation

a. Remove the Strain Relief Plate from the bottom of the Strain Relief Housing (Figure 2-13, Step 1)

b. Remove the Wiring Block from the Strain Relief Housing (Figure 2-13, Step 2).

c. Strip 8 mm (5/16 in.) of insulation from one end of each wire to connected to the Wiring Block.

d. Loosen the appropriate retaining screw, insert the stripped end of the wire into the slot, and re-tighten the retaining screw (Figure 2-14).

e. Repeat step "d" for each wire to be connected.

f. Connect the Wiring Block to the Strain Relief Housing.

g. Separate the wires into three equal bundles and route them through the cutouts in the Strain Relief Housing (if there are only a few wires, route them all through the center cutout).

h. Secure the Strain Relief Plate to the Strain Relief Housing. Tighten the screws until the plate is snug against the wires. Do not over-tighten.

i. Press the Wiring Block Assembly onto the Plug-In Assembly connector and tighten the screws at each end of the Strain Relief Housing.

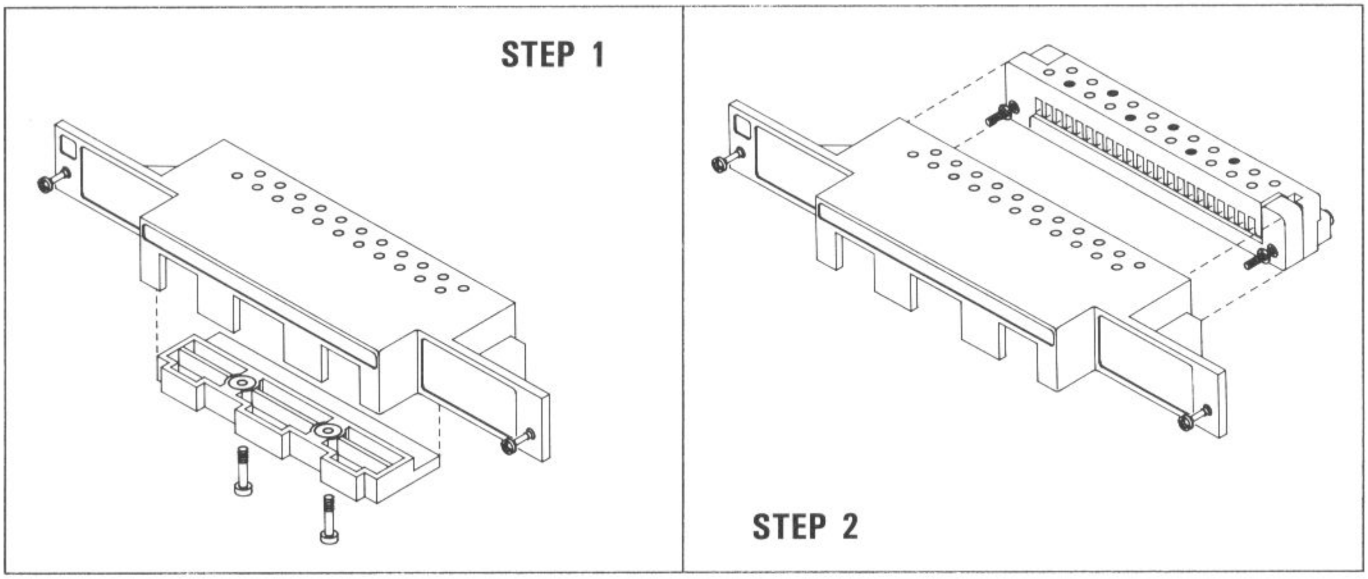

STEP 1
STEP 2

Figure 2-13. Wiring Block Disassembly

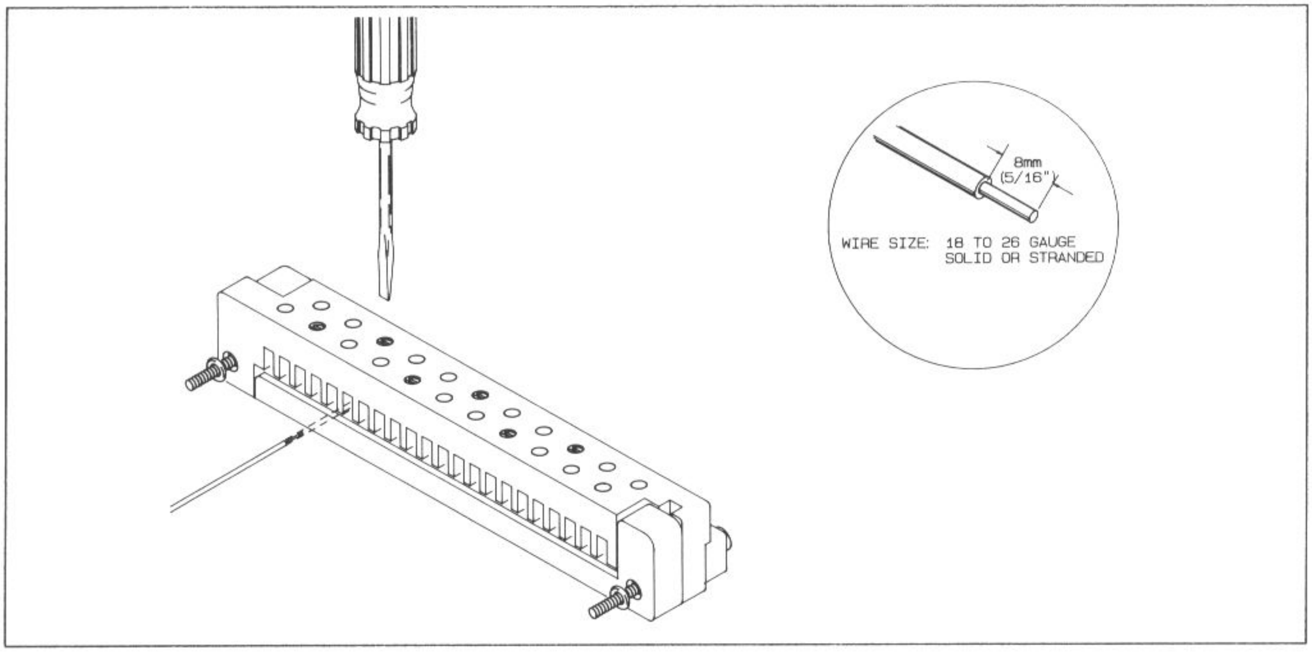

8mm
(5/16")
WIRE SIZE: 18 TO 26 GAUGE
SOLID OR STRANDED

Figure 2-14. Wire Connection

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. The information contained in this section describes manual operation of the HP 3457A Multimeter. The contents are intended to meet the needs of service personnel with emphasis on front panel operation. For more detailed information on overall operation, refer to the HP 3457A Operating Manual.

3-3. GENERAL INFORMATION

3-4. AC Power

3-5. Before connecting power to the HP 3457A, be certain the line switches on the rear panel are set for your power source and that the proper fuse is installed. Information for setting the line switches and for fuse selection is located in Section II of this manual.

3-6. Power-On

3-7. The HP 3457A automatically performs a power-on self test when it is switched on. This test takes approximately 1.5 seconds to complete and basically assures that the instrument is capable of operating. The test does not necessarily indicate that measurements will be accurate. The power-on self test checks the master processor, slave processor and the communication isolation circuitry (three of the ten tests performed by the complete self test). Upon satisfactory completion of the test, the instrument will display its HP-IB address for approximately five seconds. The address is displayed as ADDRESS-dd where "dd" is the decimal address code of the instrument (the address is set to decimal 22 at the factory). If the test can not be completed, the instrument will display FAILED. If this occurs, refer to Section VIII for troubleshooting procedures.

3-8. Upon completion of the Power-On Test, the instrument sets itself to predefined conditions (Power-On state). The power-on state conditions are listed in Table 3-1.

3-9. OPERATION

3-10. The following paragraphs describe basic operating procedures for the HP 3457A Multimeter. This section covers only front panel operating procedures such as voltage, resistance, and current measurements. Also included are manual procedures covering operation of the HP 44491A and 44492A Multiplexer Assemblies. For detailed operating information, refer to the HP 3457A Operating Manual.

3-11. Voltage Measurements (Manual Operation)

3-12. Function Selection. The measurement function is selected by pressing the appropriate key. The voltage measurement functions available are DC Volts, AC Volts and DC Coupled AC Volts. The default function is DC Volts.

- To measure DC Voltage - Press the DCV function key.
- To measure AC Voltage - Press the ACV / ACDCV function key.
- To measure DC coupled AC voltage - Press the Blue SHIFT key then the ACV / ACDCV function key.

AC BANDWIDTH (ACBAND)	SLOW
AUTO-RANGE (ARANGE)	ON
AUTO-ZERO	ON
BEEP	ON
CHANNELS CONNECTED (CHAN)	NONE
DELAY ... DEFAULT (Minimum required for accuracy)	
DIGITS DISPLAYED (NDIG)	5
DISPLAY (DISP)	ON
EMASK	32767 enabled
ERROR REGISTER	Results of Self-Test
FIXED IMPEDANCE (FIXEDZ)	OFF
FREQUENCY SOURCE (FSOURCE)	AC VOLTS
FUNCTION (FUNC)	DC VOLTS
HP-IB ADDRESS .... UNCHANGED (Factory setting 22)	
INPUT BUFFER (INBUF)	OFF
INPUT TERMINALS (TERM)	FRONT
INTEGRATION TIME (NPLC)	10 PLC
MATH FORMAT (MFORMAT)	SREAL
MATH FUNCTION (MATH)	OFF, OFF
MATH REGISTERS . All Cleared Except the following	
DEGREE	20
OFFSET	0
REFERENCE dB (REF)	1
RES	50
SCALE	1
MEMORY (MEM)	OFF
MEMORY SIZE (MSIZE)	Previous Setting
NUMBER OF READINGS PER TRIGGER (NRDGS)	1
OFFSET COMPENSATION (OCOMP)	OFF
OUTPUT FORMAT (OFORMAT)	ASCII
PROGRAM MEMORY	CLEAR
READING MEMORY	CLEAR
REQUEST SERVICE (RQS) .... Power ON bit unchanged	
SCAN ADVANCE (SADV)	HOLD
SCAN LIST (SLIST)	CHANNEL 0
STATUS REGISTER .. Pwr ON bit + Self-Test results	
TIMER	1 SEC.
TRIGGER (TRIG)	AUTO
TRIGGER ARM (TARM)	AUTO

Table 3-1. 3457A Power-On State

3-13. Range Selection. The HP 3457A Auto-Range feature automatically selects the appropriate range to measure the voltage applied. The Auto-Range feature is disabled by selecting Manual Ranging. There are 5 voltage measurement ranges available; 30 mV, 300 mV, 3 V, 30 V and 300 V. The default range is Auto-Range.

- To select Manual Ranging and maintain the present range - Press the Blue SHIFT key then the ↓/HOLD scroll key.
- To select Manual Ranging and the next higher range - Press the ↑/AUTO scroll key.
- To select Manual Ranging and the next lower range - Press the ↓/HOLD scroll key.
- To return to Auto-Ranging - Press the Blue SHIFT key then the ↑/AUTO scroll key.

3-14. Measurement Resolution. Measurement Resolution is changed by selecting the number of digits displayed. You can choose a display of 3 1/2, 4 1/2, 5 1/2 or 6 1/2 digits. The 1/2 digit refers to the most significant digit which is limited to a value of 0, 1, 2, or 3. The default number of digits displayed is 5 1/2 (most significant digit plus 5 digits).

- To change the number of digits displayed - Press the DIGITS DISP / P configuration key, enter the number 3, 4, 5 or 6 and press the ENT / LAST ENTRY key.

3-15. Integration Time. The Integration time can be changed to reduce measurement noise or to permit faster readings. The integration time is dependent upon the power line frequency and is expressed in number of power line cycles (NPLC). There are six integration times available; 100 PLC, 10 PLC, 1 PLC, .1 PLC, .005 PLC and .0005 PLC. The greater the PLC number, the quieter and more accurate the reading will be and the slower the measurement speed.

- To select the Integration Time - Press the NPLC / A configuration key, use the ↑/AUTO or ↓/HOLD scroll key to display the desired number and press the ENT / LAST ENTRY key.

The Integration Time can also be changed by pressing the NPLC/A *key, entering the desired number directly, and pressing the* ENT/LAST ENTRY *key.*

3-16. Input Connections. For voltage measurements, the input voltage is connected to the INPUT HI and LO Terminals. This is true for both Front and Rear Terminal operation. When using one of the optional Plug-In assemblies, the input is connected to the HI and LO inputs of a particular channel.

3-17. Front/Rear Input Selection. The Input configurations are Front Terminals, Rear Terminals/Scanner or Open. Only one input configuration (front, rear, scanner or open) can be selected at a time.

- To select Input configuration - Press the TERM / M configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display the desired input and press the ENT / LAST ENTRY key.

The input can also be changed by pressing the TERM/M *key, entering the appropriate number, and pressing the* ENT/LAST ENTRY *key.*

3-18. Resistance Measurements (Manual Operation)

3-19. Function Selection. The measurement function is selected by pressing the appropriate function key. The resistance measurement functions available are 2-Wire Ohms and 4-Wire Ohms.

- To select 2-Wire resistance measurements - Press the OHM / OHMF function key.

- To select 4-Wire resistance measurements - Press the Blue SHIFT key then the OHM / OHMF key.

3-20. Range Selection. The Auto-Range feature automatically selects the appropriate range for the resistance being measured. The Auto-Range feature is disabled by selecting Manual Ranging. There are 9 resistance measurement ranges available; 30 Ohms, 300 Ohms, 3 KOhms, 30 KOhms, 300 KOhms, 3 MOhms, 30 MOhms, 300 MOhms and 3 GOhms. The extended ohms ranges (300 MOhms and 3 GOhms) are available only for 2-Wire resistance measurements. The default range is Auto-Range.

- To select Manual Ranging and maintain the present range - Press the Blue SHIFT key then the ↓/HOLD scroll key.

- To select Manual Ranging and the next higher range - Press the ↑/AUTO scroll key.

- To select Manual Ranging and the next lower range - Press the ↓/HOLD scroll key.

- To return to Auto-Ranging - Press the Blue SHIFT key then the ↑/AUTO scroll key.

3-21. Measurement Resolution. Measurement Resolution is changed by selecting the number of digits displayed. You can choose a display of 3 1/2, 4 1/2, 5 1/2 or 6 1/2 digits. The 1/2 digit refers to the most significant digit which is limited to a value of 0, 1, 2, or 3. The default number of digits displayed is 5 1/2 (most significant digit plus 5 digits).

- To change the number of digits displayed - Press the DIGITS DISP / P configuration key, enter the number 3, 4, 5 or 6 and press the ENT / LAST ENTRY key.

3-22. Integration Time. The Integration time can be changed to reduce measurement noise or to permit faster readings. The integration time is dependent upon the power line frequency and is expressed in number of power line cycles (NPLC). There are six integration times available; 100 PLC, 10 PLC, 1 PLC, .1 PLC, .005 PLC and .0005 PLC. The greater the PLC number, the quieter and more accurate the reading will be and the slower the measurement speed.

- To select the Integration Time - Press the NPLC / A configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display the desired number and press the ENT / LAST ENTRY key.

The Integration Time can also be changed by pressing the NPLC/A *key, entering the desired number directly using the MATH keys and pressing the* ENT/LAST ENTRY *key.*

3-23. Input Connections. For 2-Wire Ohms measurements, the unknown resistance is connected to the INPUT HI and LO terminals. This applies to both front and rear terminal operation. When using one of the optional Plug-In assemblies, the input would be connected to the HI and LO inputs of a particular channel. For 4-Wire Ohms measurements, the unknown resistance is connected to the INPUT HI and LO terminals and to the Ω SENSE HI and LO terminals as shown in Figure 3-1. When using the HP 44491A General Purpose Multiplexer assembly, the unknown resistance is connected as shown in Figure 3-2.

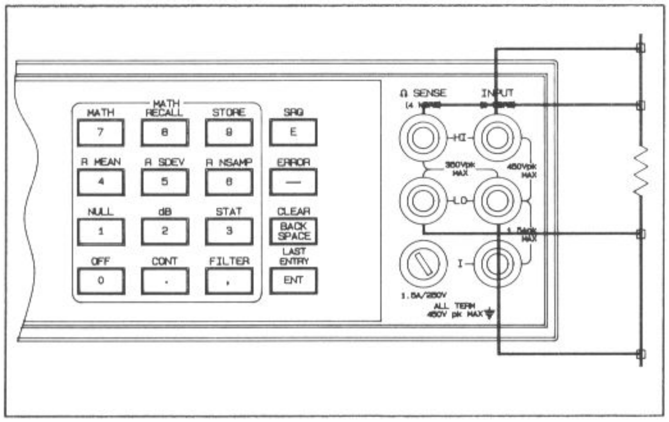


Figure 3-1. Front Panel Connections

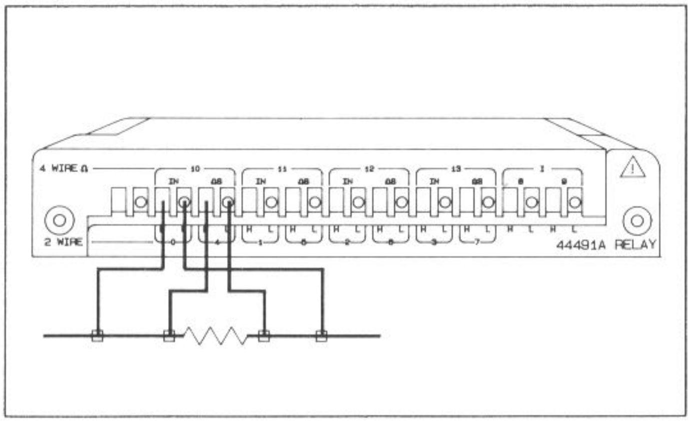


Figure 3-2. Plug-In Connections

3-24. Front/Rear Input Selection. The Input configurations are Front Terminals, Rear Terminals/Scanner or Open. Only one input configuration (front, rear, scanner or open) can be selected at a time.

- To select Input configuration - Press the TERM / M configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display the desired input and press the ENT / LAST ENTRY key.

The input can also be changed by pressing the TERM/M *key, entering the appropriate number using the MATH keys and pressing the* ENT/LAST ENTRY *key.*

3-25. Current Measurements (Manual Operation)

3-26. Function Selection. The measurement function is selected by pressing the appropriate function key. The current measurement functions available are DC Current, AC Current and DC Coupled AC Current.

- To select DC Current - Press the DCI function key.
- To select AC Current - Press the ACI / ACDCI function key.
- To select DC coupled AC Current - Press the Blue SHIFT key then the ACI / ACDCI function key.

3-27. Range Selection. The Auto-Range feature automatically selects the appropriate range for the current being measured. The Auto-Range feature can be disabled by selecting Manual Ranging. There are 5 DC current ranges available; 300 uA, 3 mA, 30 mA, 300 mA and 1 A. There are 3 AC current ranges available; 30 mA, 300 mA and 1 A. The maximum input current for DC or AC inputs is 1.5 A peak. The default range is Auto-Range.

- To select Manual Ranging and maintain the present range - Press the Blue SHIFT key then the ↓/HOLD scroll key.
- To select Manual Ranging and the next higher range - Press the ↑/AUTO scroll key.
- To select Manual Ranging and the next lower range - Press the ↓/HOLD scroll key.
- To return to Auto-Ranging - Press the Blue SHIFT key then the ↑/AUTO scroll key.

3-28. Measurement Resolution. Measurement Resolution is changed by selecting the number of digits displayed. You can choose a display of 3 1/2, 4 1/2, 5 1/2 or 6 1/2 digits. The 1/2 digit refers to the most significant digit which is limited to a value of 0, 1, 2, or 3. The default number of digits displayed is 5 1/2 (most significant digit plus 5 digits).

- To change the number of digits displayed - Press the DIGITS DISP / P configuration key, enter the number 3, 4, 5 or 6 and press the ENT / LAST ENTRY key.

3-29. Integration Time. The Integration time can be changed to reduce measurement noise or to permit faster readings. The integration time is dependent upon the power line frequency and is expressed in number of power line cycles (NPLC). There are six integration times available; 100 PLC, 10 PLC, 1 PLC, .1 PLC, .005 PLC and .0005 PLC. The greater the PLC number, the quieter and more accurate the reading will be and the slower the measurement speed.

- To select the Integration Time - Press the NPLC / A configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display the desired number and press the ENT / LAST ENTRY key.

The Integration Time can also be changed by pressing the **NPLC/A** *key, entering the desired number directly using the MATH keys and pressing the* **ENT/LAST ENTRY** *key.*

3-30. Input Connections. For current measurements, the input current is applied to the INPUT I and LO Terminals. This applies to both Front and Rear Terminal operation. When using the HP 44491A Plug-In assembly, the input is connected to the I and LO inputs of either channel 8 or channel 9.

3-31. Front/Rear Input Selection. The Input configurations are Front Terminals, Rear Terminals/Scanner or Open. Only one input configuration (front, rear, scanner or open) can be selected at a time.

- To select Input configuration - Press the TERM / M configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display the desired input and press the ENT / LAST ENTRY key.

The input can also be changed by pressing the **TERM/M** *key, entering the appropriate number using the MATH keys and pressing the* **ENT/LAST ENTRY** *key.*

3-32. Frequency/Period Measurements (Manual Operation)

3-33. Function Selection. The measurement function is selected by pressing the appropriate key. The functions available are Frequency and Period.

- To select Frequency - Press the FREQ / PER function key.
- To select Period - Press the Blue SHIFT key then the FREQ / PER function key.

3-34. Range Selection. The HP 3457A has an Auto-Range feature which automatically selects the proper range to measure the signal applied.

3-35. Measurement Resolution. Measurement Resolution is changed by selecting the number of digits displayed. You can choose a display of 3 1/2, 4 1/2, 5 1/2 or 6 1/2 digits. The 1/2 digit refers to the most significant digit which is limited to a value of 0, 1, 2, or 3. The default number of digits displayed is 5 1/2 (most significant digit plus 5 digits).

- To change the number of digits displayed - Press the DIGITS DISP / P configuration key, enter the number 3, 4, 5 or 6 and press the ENT / LAST ENTRY key.

3-36. Integration Time. The Integration time can be changed to reduce measurement noise or to permit faster readings. The integration time is dependent upon the power line frequency and is expressed in number of power line cycles (NPLC). There are six integration times available; 100 PLC, 10 PLC, 1 PLC, .1 PLC, .005 PLC and .0005 PLC. The greater the PLC number, the quieter and more accurate the reading will be and the slower the measurement speed.

- To select the Integration Time - Press the NPLC / A configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display the desired number and press the ENT / LAST ENTRY key.

The Integration Time can also be changed by pressing the NPLC/A *key, entering the desired number directly using the MATH keys and pressing the* ENT/LAST ENTRY *key.*

3-37. Input Connections. For frequency/period measurements, the input signal is applied to the INPUT HI and LO Terminals. This applies to both Front and Rear Terminal operation. When using one of the optional Plug-In assemblies, the input is connected to the HI and LO inputs of a particular channel.

3-38. Front/Rear Input Selection. The Input configurations are Front Terminals, Rear Terminals/Scanner or Open. Only one input configuration (front, rear, scanner or open) can be selected at a time.

- To select Input configuration - Press the TERM / M configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display the desired input and press the ENT / LAST ENTRY key.

The input can also be changed by pressing the TERM/M *key, entering the appropriate number using the MATH keys and pressing the* ENT/LAST ENTRY *key.*

3-39. HP 44491A General Purpose Multiplexer (Manual Operation)

3-40. The HP 44491A General Purpose Multiplexer has eight 2-wire input channels numbered 0 through 7 and two current/actuator channels numbered 8 and 9. The 2-wire input channels can also be configured as four 4-wire input channels. In this configuration the input channels are numbered 10 through 13.

3-41. Measurement Selection. Determine the type of measurement you wish to make (Voltage, Resistance, Current, Frequency/Period) and set the instrument for that measurement as described in the previous paragraphs.

3-42. Input Selection. When using the General Purpose Multiplexer, the instrument must be set for Rear or Scanner inputs.

- To select Rear Inputs - Press the TERM / M configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display REAR or SCANNER and press the ENT / LAST ENTRY key.

3-43. Channel Selection. Only one input channel, either 2-wire or 4-wire, plus one actuator channel can be selected at a time. When an input channel is closed, the channel previously closed is opened. The same applies to the actuator channels.

- To select an input channel - Press the CHAN / N configuration key, enter the number of the channel to be closed and press the ENT / LAST ENTRY key.
- To close one of the actuator channels - Press the Blue SHIFT key then the OFFSET COMP / C key. Use the ↓/HOLD scroll key to display CLOSE. Enter the number of the actuator channel to be closed (8 or 9) and press the ENT / LAST ENTRY key.
- To open all channels - Press the Blue SHIFT key then the OFFSET COMP / C key. Use the ↓/HOLD scroll key to display CRESET and press the ENT / LAST ENTRY key.

3-44. Scanning. The instrument can be set to automatically take a number of readings and store them in memory. This makes it possible to measure some or all of the input channels and recall the measurements taken. The following is a simple procedure to measure inputs connected to channels 0 through 7 of the HP 44491A Multiplexer.

- Determine the type of measurement you wish to make (Voltage, Resistance, Current, Frequency/Period) and set the instrument for that measurement as described in the previous paragraphs.
- Select the Rear/Scanner input - Press the TERM / M configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display REAR:2 or SCANNER:2 and press the ENT / LAST ENTRY key.
- Set the Trigger to Hold - Press the Blue SHIFT key then the STORE / T configuration key. Use the ↓/HOLD scroll key to display the TRIG command. Press the → display key once to hold the command. Use the ↑/AUTO or ↓/HOLD scroll key to display HOLD:4 and press the ENT / LAST ENTRY key.
- Set the number of readings for the number of measurements to be made (in this case 8) - Press the NRDGS / L configuration key, enter the number 8 and press the ENT / LAST ENTRY key.
- Set the Scan Advance to Auto - Press the SCAN ADV / O configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display AUTO:2 and press the ENT / LAST ENTRY key.
- Enable the Reading Memory - Press the CONFIG / P configuration key then the ENT / LAST ENTRY key.
- Allocate Reading Memory space (each reading requires 4 bytes of memory) - Press the Blue SHIFT key then the TERM / M configuration key. Use the ↓/HOLD scroll key to display MSIZE. Enter the number 32 (8 readings times 4 bytes) and press the ENT / LAST ENTRY key.
- Select the channels to be measured - Press the Blue SHIFT key then the RECALL / S configuration key. Use the ↓/HOLD scroll key to display SLIST. Enter the number of each channel you wish to measure followed by a comma (,) to separate them (example: 0,1,2,3,4,5,6,7). Press the ENT / LAST ENTRY key. *(As many as 16 single digit channel numbers or 8 double digit channel numbers can be entered at one time. The number of readings (NRDGS) should be set for the number of channels entered).*

- Make the measurement - Press the SINGLE / F configuration key to start the measurement sequence. The instrument will read each channel listed and store the readings in memory.

- Recall the readings - Press the Reading Memory RECALL / S key then the ENT / LAST ENTRY key. The reading displayed is the last reading taken. The readings are shifted into memory so that the first reading taken is in the highest number memory location. The last reading taken is in memory location 1. Use the ↑/AUTO and ↓/HOLD scroll keys to view the measurement readings. Use the ←/TEST and →/RESET display keys to read the total display contents.

- To repeat the same set of measurements - Press the CONFIG / R configuration key then the ENT / LAST ENTRY key to clear the reading memory. Press the SINGLE / F configuration key to start the new reading sequence.

3-45. HP 44492A Reed Relay Multiplexer (Manual Operation)

3-46. The HP 44492A Reed Relay Multiplexer has ten 2-wire input channels numbered 0 through 9. This multiplexer is used to make voltage, resistance and frequency or period measurements. It is not designed to make 4-wire ohms or current measurements.

3-47. Measurement Selection. Determine the type of measurement you wish to make (Voltage, Resistance or Frequency/Period) and set the instrument for that measurement as described in the previous paragraphs.

3-48. Input Selection. To use the Reed Relay Multiplexer, the instrument must be set to the Rear/Scanner input.

- Select the Rear/Scanner input - Press the TERM / M configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display REAR:2 or SCANNER:2 and press the ENT / LAST ENTRY key.

3-49. Channel Selection. Only one input channel can be selected at a time. When an input channel is closed, the channel previously closed is automatically opened.

- To select an input channel - Press the CHAN / N configuration key, enter the number of the channel to be closed and press the ENT / LAST ENTRY key.

- To open all channels - Press the Blue SHIFT key then the OFFSET COMP / C key. Use the ↓/HOLD scroll key to display CRESET and press the ENT / LAST ENTRY key.

3-50. Scanning. The instrument can be set to automatically take a number of readings and store them in memory. This makes it possible to measure some or all of the input channels and recall the measurements taken. The following is a simple procedure to measure inputs connected to channels 0 through 9 of the HP 44492A Reed Relay Multiplexer.

- Determine the type of measurement you wish to make (Voltage, 2-Wire Resistance, Frequency/Period) and set the instrument for that measurement as described in the previous paragraphs.

- Select the Rear/Scanner input - Press the TERM / M configuration key. Use the ↑/AUTO or ↓/HOLD scroll key to display REAR:2 or SCANNER:2 and press the ENT / LAST ENTRY key.

- Set the Trigger to Hold - Press the Blue SHIFT key then the STORE / T configuration key. Use the ↓/HOLD scroll key to display the TRIG command. Press the →/RESET display key once to hold the command. Use the ↑/AUTO or ↓/HOLD scroll key to display HOLD:4 and press the ENT / LAST ENTRY key.

- Set the number of readings to match the number of measurements to be made (in this case 10) - Press the NDRGS / L configuration key, enter the number 10 and press the ENT / LAST ENTRY key.

- Set the Scan Advance to Auto - Press the SCAN ADV / O configuration key. Use the ↑ / AUTO or ↓ / HOLD scroll key to display AUTO:2 and press the ENT / LAST ENTRY key.

- Enable the Reading Memory - Press the CONFIG / R configuration key then the ENT / LAST ENTRY key.

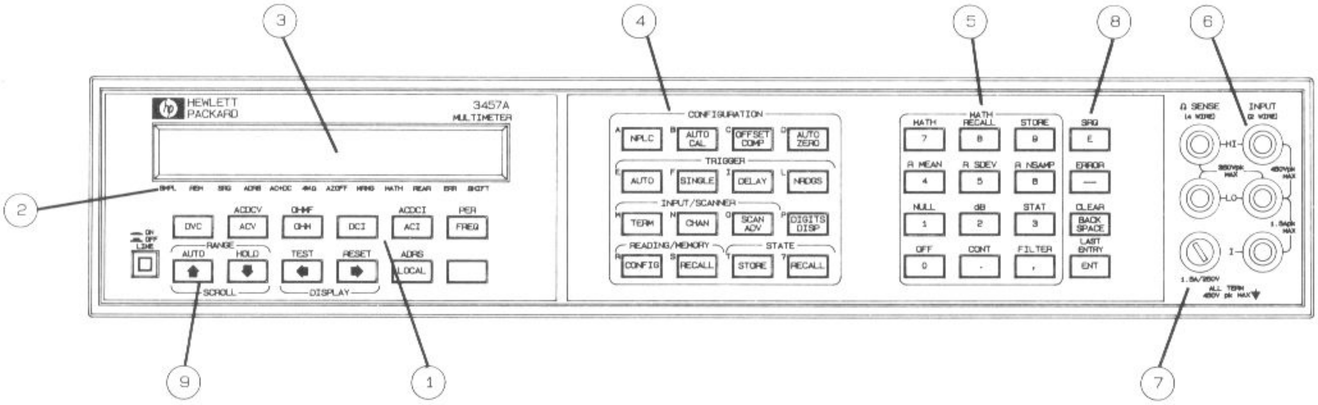
- Allocate Reading Memory space (each reading requires 4 bytes of memory) - Press the Blue SHIFT key then the TERM / M configuration key. Use the ↓ / HOLD scroll key to display MSIZE. Enter the number 40 (10 readings times 4 bytes) and press the ENT / LAST ENTRY key.

- Select the channels to be measured - Press the Blue SHIFT key then the RECALL / S configuration key. Use ↓ / HOLD scroll key to display SLIST. Enter the number of each channel you wish to measure followed by a comma (,) to separate them (example: 0,1,2,3,4,5,6,7,8,9). Press the ENT / LAST ENTRY key. (As many as 16 single digit channel numbers can be entered at one time. The number of readings (NRDGS) should be set to match the number of channels entered).

- Make the measurement - Press the SINGLE / F configuration key to start the measurement sequence. The instrument will read each channel listed and store the readings in memory.

- Recall the readings - Press the Reading Memory RECALL / S key then the ENT / LAST ENTRY key. The reading displayed is the last reading taken. The readings are shifted into memory so that the first reading taken is in the highest number memory location. The last reading taken is in memory location 1. Use the ↑ / AUTO and ↓ / HOLD scroll keys to view the measurement readings. Use the ← and → display keys to read the total display contents.

- To repeat the same set of measurements - Press the CONFIG / R configuration key then the ENT / LAST ENTRY key to clear the reading memory. Press the SINGLE / F configuration key to start the new reading sequence.


3
4
5
8
6
2
9
1
7
HEWLETT PACKARD
3457A
MULTIMETER
SMPL REM SRQ ADRS AC+DC 4WΩ AZOFF MRNG MATH REAR ERR SHIFT
ON
OFF
LINE
ACDCV
OHMF
ACDCI
PER
DVC
ACV
OHM
DCI
ACI
FREQ
RANGE
AUTO
HOLD
TEST
RESET
ADRS
LOCAL
SCROLL
DISPLAY
CONFIGURATION
NPLC
AUTO CAL
OFFSET COMP
AUTO ZERO
TRIGGER
AUTO
SINGLE
DELAY
NRDGS
INPUT/SCANNER
TERM
CHAN
SCAN ADV
DIGITS DISP
READING/MEMORY
CONFIG
RECALL
STATE
STORE
RECALL
MATH
MATH
RECALL
STORE
R MEAN
R SDEV
R NSAMP
NULL
dB
STAT
OFF
CONT
FILTER
SRQ
E
ERROR
CLEAR
BACK SPACE
LAST ENTRY
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
LO
I
1.5A/250V
ALL TERM 450V pk MAX

① **FUNCTION KEYS** - The function keys select the type of measurement. Available functions are: DC volts (DCV), AC volts (ACV), AC+DC volts (ACDCV), 2-Wire Ohms (OHM), 4-Wire Ohms (OHMF), DC current (DCI), AC current (ACI), AC+DC current (ACDCI), Frequency (FREQ) and Period (PER).

② **ANNUNCIATORS** - The 12 annunciators across the bottom of the display indicate the present operating conditions of the instrument. The purpose of each annunciator is as follows:

SMPL - The Sample annunciator flashes to indicate display updates. The maximum display rate is 5 updates per second. The annunciator does not indicate measurement rate.

REM - The Remote annunciator is on when the instrument is being controlled from the HP-IB.

SRQ - The Service Request annunciator is on when the instrument is requesting service from the controller.

ADRS - The Addressed annunciator is on when the instrument has been addressed to talk or listen on the bus.

AC+DC - The AC+DC annunciator is on when the DC coupled AC voltage or current function has been selected.

4WΩ - The 4-Wire Ohms annunciator is on when the 4-Wire Ohms function has been selected.

AZOFF - The Auto-Zero Off annunciator is on when the Auto-Zero feature has been disabled.

MRNG - The Manual Range annunciator indicates the Auto-Ranging feature has been disabled.

MATH - The Math annunciator is on when the mathematics feature the mathematics feature has been selected.

REAR - The Rear Input annunciator indicates that the Rear Input Terminals have been selected.

ERR - The Error annunciator flashes when an error condition exists. Error information is stored in the error registers.

SHIFT - The Shift annunciator is activated when the blue shift key is pressed.

Figure 3-3. Front Panel Features

③ **DISPLAY** - The display is a 12 character alphanumeric liquid crystal display (LCD). The display is used to show measurement readings and to display messages. When measurements are displayed, the first character indicates the polarity, characters 2 through 8 display the measurement value and the last four characters provide function and range information. The display buffer stores up to 24 characters. Use the ← and → display keys to view displays in excess of 12 characters.

④ **CONFIGURATION KEYS** - The Math Keys are used to set the operating parameters of the instrument. These keys permit the user to access the command catalog to configure 62 operating parameters. The most commonly used parameters are set by pressing one of the sixteen configuration keys and entering the appropriate parameter value.

⑤ **MATH KEYS** - The Math Keys access 13 built-in mathematical functions.

⑥ **INPUT TERMINALS** - The five Input Terminals provide HI and LO input conections voltage resistance and current measurements. DC voltage, AC voltage, AC+DC voltage and 2-Wire resistance measurements are made through the INPUT HI and LO terminals. DC current AC current and AC+DC current measurements are made through the INPUT LO and I terminals. 4-Wire resistance measurements are made through the Ω SENSE HI and LO terminals and the INPUT HI and LO terminals.

⑦ **FUSE** - The fuse protects the current input circuitry by limiting the input current to 1.5 amps.

⑧ **OTHER KEYS** - These special keys perform the following functions:

E/SRQ key - In the normal state this key allows the user to enter exponents (E). In the shifted state, this key sets the Request Service bit.

-/ERROR key - In the normal state, this key is used to enter negative numbers. In the shifted state, this key is used to read the Error Register.

BACK SPACE/CLEAR key - In the normal state, this key is used to back space to correct entries. In the shifted state, this key clears the display.

ENT/LAST ENTRY key - In the normal state, this key is used to enter information into memory. In the shifted state, this key recalls the last entry made.

⑨ **DISPLAY KEYS** - These keys are used to change measurement ranges, scroll through the command catalog, shift display messages left or right, run the instrument self test routine, reset the instrument, read the HP-IB address and return the instrument to local (manual) control.

Figure 3-3. Front Panel Features (cont'd)

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. Section IV contains Performance Tests designed to verify the accuracy of the HP 3457A Multimeter. Accuracy specifications are listed in Table 1-1 of this manual. This section also contains Operational Verification Tests which provide a more rapid method of testing the operation and accuracy of the unit. The Operational Verification Tests are designed to provide a 90% confidence that the HP 3457A is operational and meets specifications. Both the Performance Tests and Operational Verification Tests can be performed without access to the interior of the instrument.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required for the performance tests and operational verification tests are listed in the Recommend Test Equipment table in Section I of this manual. Equipment other than that recommended may be used as long as the critical specifications are met.

4-5. TEST RECORD

4-6. Results of the performance or operational verification tests may be tabulated on the Test Record located at the end of the respective procedures. The Test Record lists all of the tested specifications and their acceptable limits. It is suggested that the performance tests or operational verification tests be performed and the results tabulated when the instrument is received. These results can be used for comparison with periodic calibration results.

4-7. CALIBRATION CYCLE

4-8. This instrument requires periodic performance verification. The frequency at which the instrument should be tested is dependent upon its usage and the environmental operating conditions. To maintain 24 hour specifications, the instrument should be checked daily; to maintain 90 day specifications, the instrument should be checked at 90 day intervals. It is suggested that the performance test be performed at 90 day intervals for normal operation.

4-9. TEST CONSIDERATIONS

4-10. General

4-11. Because the HP 3457A is capable of making high accuracy measurements, certain requirements need to be made. For example, standards being used to test accuracy should not introduce any significant uncertainties in the performance tests. A standard which is ten times more accurate than the HP 3457A nearly eliminates uncertainties. In most cases, standards with these accuracies are not readily available, therefore, a compromise is necessary. A primary in house standard, one which has been certified by the National Bureau of Standards (NBS) and can supply the necessary outputs, is recommended. If a primary standard is not available, one of the following may be appropriate:

a. Use a standard which is three or four times more accurate than the HP 3457A specifications to be tested. Keep in mind, however, the potential uncertainties these standards may introduce.

b. Use a highly stable calibrated standard and add the correction factors (usually supplied on the calibration charts) to the test reading.

c. Send the HP 3457A to an HP Service Center or other NBS-certified standards facility for calibration.

4-12. PERFORMANCE TESTS

The Performance Tests are divided into 6 main tests, DC Volts, AC Volts, DC Current, AC Current, Ohms, and Frequency. Each test can be performed independently of the others. The steps within each test, however, should be performed in order.

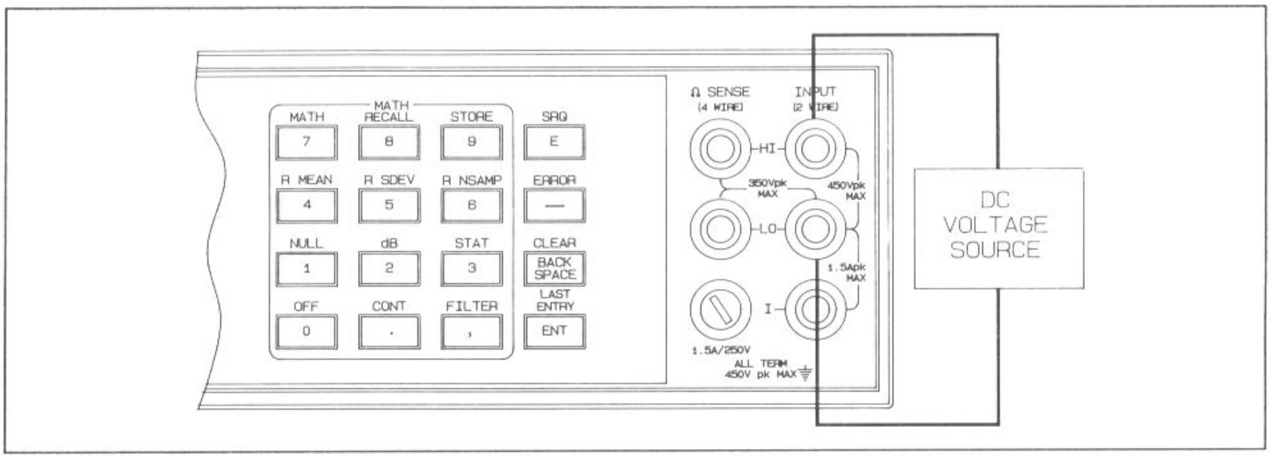

MATH
MATH RECALL
STORE
SRQ
7
8
9
E
R MEAN
R SDEV
R NSAMP
ERROR
4
5
6
—
NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
OFF
CONT
FILTER
LAST ENTRY
0
.
,
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX
DC VOLTAGE SOURCE

Figure 4-1. DCV Performance Test Connections

NOTE

The temperature of the environment where these tests are to be performed must be within ±5° C of the temperature where the instrument was calibrated. The instrument was calibrated at the factory in an area with a temperature of 24° C (± 1° C).

4-13. Preliminary Steps

1. Turn the instrument ON and allow a one hour warm-up period.

2. Be certain all external inputs are disconnected from the HP 3457A. Run the TEST routine. The test result must read "SELF TEST OK". If the display shows "TEST FAILED", the instrument probably needs repair.

3. Run the AUTO CAL routine. (Press the AUTO CAL key, enter the number 1 and press the ENT key).

DC Voltage Performance Tests

4-14. DC Voltage Function - Offset Test

4-15. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Connect a low thermal short across the Front Panel HI and LO Input Terminals.

2. Set the HP 3457A to the DC Voltage function (DCV) and the number of digits displayed (DIGITS DISP) to six.

DC Voltage Performance Tests Cont'd

3457A Input	3457A Range	3457A Set Up	90 day limits		1 year limits	
			High	Low	High	Low
Short	300 V	DCV	+000.0007 V	-000.0007 V	+000.0007 V	-000.0007 V
Short	30 V	DCV	+ 00.00020 V	- 00.00020 V	+ 00.00020 V	- 00.00020 V
Short	3 V	DCV	+ 0.000007 V	- 0.000007 V	+ 0.000007 V	- 0.000007 V
Short	300 mV	DCV	+000.0040 mV	-000.0040 mV	+000.0040 mV	-000.0040 mV
Short	30 mV	DCV	+ 00.00385 mV	- 00.00385 mV	+ 00.00385 mV	- 00.00385 mV
30 mV	30 mV	DCV	+ 30.00505 mV	+ 29.99495 mV	+ 30.00520 mV	+ 29.99480 mV
300 mV	300 mV	DCV	+300.0115 mV	+299.9885 mV	+300.0145 mV	+299.9855 mV
3 V	3 V	DCV	+ 3.000058 V	+ 2.999942 V	+ 3.000082 V	+ 2.999918 V
2 V	3 V	DCV	+ 2.000041 V	+ 1.999959 V	+ 2.000057 V	+ 1.999943 V
1 V	3 V	DCV	+ 1.000024 V	+ 0.999976 V	+ 1.000032 V	+ 0.999968 V
-1 V	3 V	DCV	- 0.999976 V	- 1.000024 V	- 0.999968 V	- 1.000032 V
-2 V	3 V	DCV	- 1.999959 V	- 2.000041 V	- 1.999943 V	- 2.000057 V
-3 V	3 V	DCV	- 2.999942 V	- 3.000058 V	- 2.999918 V	- 3.000082 V
30 V	30 V	DCV	+ 30.00125 V	+ 29.99875 V	+ 30.00140 V	+ 29.99860 V
300 V	300 V	DCV	+300.0157 V	+299.9843 V	+300.0172 V	+299.9828 V

Table 4-1. DC Voltage Test Limits

3. Test the HP 3457A input offset on the 300 V, 30 V, 3 V, 300 mV and 30 mV ranges and record the reading of each range on the Test Record provided at the end of this section. Begin with the 300 V range to allow any thermal voltages which might affect the readings on the lower ranges to dissipate.

4. If any of the offset readings are beyond the limits specified on the Test Record, the instrument should be calibrated or repaired. Refer to Section V of this manual for calibration procedures.

5. Remove the short from the Front Panel Input Terminals.

4-16. DC Voltage Function - Gain Test

4-17. Equipment Required. A DC Voltage Standard capable of providing 30 mV (± .0055%), 300 mV (± .0012%), 1 V, 2 V and 3 V (± .0006%), 30 V (± .0013%) and 300 V (± .0017%) is required for this procedure.

1. Set the output of the DC Voltage Standard to 30 mV and connect it to the HP 3457A front panel HI and LO Input Terminals. See Figure 4-1.

2. Use the Test Record to record the full-scale readings for the 30 mV, 300 mV, 3 V, 30 V and 300 V ranges. Begin with the 30 mV range.

3. If any of the full-scale readings are beyond the specified limits, refer to Section V for calibration procedures.

4. Reduce the output of the Voltage Standard to 3 volts.

DC Voltage Performance Tests Cont'd

4-18. DC Voltage Function - Linearity Test

4-19 Equipment Required. A DC Voltage Standard capable of providing 1 V, 2 V and 3 V (± .0006%) is required for this procedure.

1. Set the HP 3457A to the 3 V range.

2. Set the Voltage Standard to 3 V, 2 V and 1 V. Use the Test Record to record the 3 V, 2 V and 1 V readings.

3. Reverse the leads at the Input Terminals of the HP 3457A to provide a negative input voltage.

4. Set the Voltage Standard to 1 V, 2 V and 3 V. Use the Test Record to record the -1 V, -2 V and -3 V readings.

6. If any of the linearity readings are beyond the limits specified, refer to Section V for calibration procedures. If the problem can not be corrected with calibration, refer to Section VIII for troubleshooting information.

7. Disconnect the DC Voltage Standard from the HP 3457A Input Terminals.

AC Voltage Performance Tests

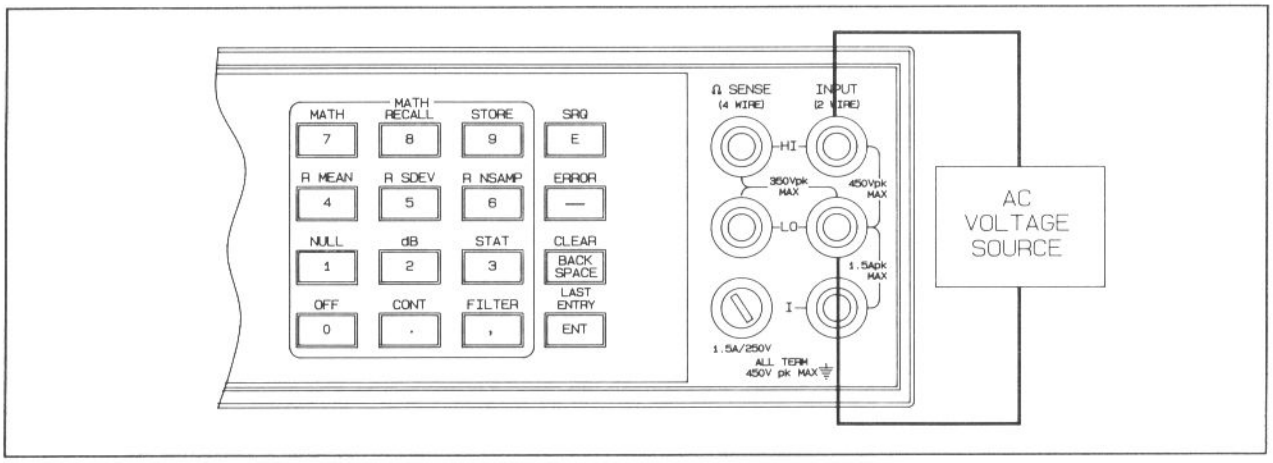

MATH
MATH RECALL
STORE
SRQ
7
8
9
E
R MEAN
R SDEV
R NSAMP
ERROR
4
5
6
—
NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
OFF
CONT
FILTER
LAST ENTRY
0
.
,
ENT
Ω SENSE
(4 WIRE)
INPUT
(2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM
450V pk MAX
AC VOLTAGE SOURCE

Figure 4-2. ACV Performance Test Connections

4-20. AC Voltage Function - Gain Test

4-21. Equipment Required. An AC Signal Source capable of providing sine-wave voltages of 30 mV, 300 mV, 1 V, 2 V, 3 V, 30 V and 300 V (± 0.1%) at a frequency of 1 KHz is required for the following procedure.

1. Set the output of the AC Signal Source for an output voltage of 30 mV at a frequency of 1 KHz and connect it to the HP 3457A front panel HI and LO input terminals.

AC Voltage Performance Tests Cont'd

2. Use the Test Record to record the 30 mV, 300 mV, 3 V, 30 V and 300 V full-scale readings beginning with the 30 mV range.

3. Test the HP 3457A accuracy at one-tenth of full-scale on the 300 V, 30 V, 3 V and 300 mV ranges. Set the HP 3457A to each range and the AC Signal Source to provide a voltage equal to one-tenth of the full-scale value of the range selected. Use the Test Record to record the readings for each range.

4. If any of the gain readings are beyond the limits specified in Table 4-2 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V of this manual for calibration procedures.

5. Set the AC Voltage Standard for an output of 30 mV.

3457A Input	Input Freq.	3457A Range	3457A Set Up	90 day limits High	Low
30 mV	1 kHz	30 mV	ACV	30.05020 mV	29.94980 mV
300 mV	1 kHz	300 mV	ACV	300.5020 mV	299.4980 mV
1 V	1 kHz	3 V	ACV	1.002420 V	0.997580 V
2 V	1 kHz	3 V	ACV	2.003720 V	1.996280 V
3 V	1 kHz	3 V	ACV	3.005100 V	2.994900 V
30 V	1 kHz	30 V	ACV	30.05020 V	29.94980 V
300 V	1 kHz	300 V	ACV	300.6820 V	299.3180 V
30 V	1 kHz	300 V	ACV	030.1690 V	029.8310 V
3 V	1 kHz	30 V	ACV	03.01510 V	02.98490 V
300 mV	1 kHz	3 V	ACV	0.301510 V	0.298490 V
30 mV	1 kHz	300 mV	ACV	030.1510 mV	029.8490 mV

Table 4-2. AC Gain Test Limits

4-22. AC Voltage Function - Frequency Response Test

4-23. Equipment Required. An AC Signal Source capable of providing sine-wave voltages of 30 mV, 300 mV and 3 V at frequencies of 1 MHz, 300KHz, 100 KHz, 20 KHz, 6.5 KHz, 400 Hz, 100 Hz, 45 Hz and 20 Hz is required for the following procedure. Table 4-3 lists the required accuracy of the test equipment.

VOLTAGE	FREQUENCY 1MHz	300KHz	100KHz	20KHz	6.5KHz	400Hz	100Hz	45Hz	20Hz
30 mV	+- 10%	+- 2%	+- .6%	+- .3%	+- .3%	+- .3%			
300 mV	+- 3%	+- 1%	+- .2%	+- .2%	+- .2%	+- .2%	+- .1%	+- .3%	+- .3%
3 V	+- 3%	+- 1%	+- .2%	+- .2%	+- .2%	+- .2%	+- .1%	+- .3%	+- .3%

Table 4-3. AC Signal Source Voltage Accuracy Requirements

1. Set the AC Voltage Standard for an output voltage of 30 mV and connect it to the HP 3457A front panel HI and LO input terminals.

AC Voltage Performance Tests Cont'd

3457A Input	Input Freq.	3457A Range	3457A Set Up	90 day Limits High	Low
30 mV	1 MHz	300 mV	ACF	039.6880 mV	020.3120 mV
" "	300 kHz	" "	"	031.9180 mV	028.0820 mV
" "	100 kHz	" "	"	030.4080 mV	029.5920 mV
" "	20 kHz	" "	"	030.1510 mV	029.8490 mV
" "	6.5 kHz	" "	"	030.1510 mV	029.8490 mV
" "	400 Hz	" "	"	030.1510 mV	029.8490 mV
300 mV	1 MHz	300 mV	ACF	337.1200 mV	262.8800 mV
" "	300 kHz	" "	"	310.4500 mV	289.5500 mV
" "	100 kHz	" "	"	302.1900 mV	297.8100 mV
" "	20 kHz	" "	"	300.5320 mV	299.4680 mV
" "	6.5 kHz	" "	"	300.5320 mV	299.4680 mV
" "	400 Hz	" "	"	300.5320 mV	299.4680 mV
300 mV	1 MHz	3 V	ACF	0.396880 V	0.203120 V
" "	300 kHz	"	"	0.319180 V	0.280280 V
" "	100 kHz	"	"	0.304080 V	0.295920 V
" "	20 kHz	"	"	0.301510 V	0.298490 V
" "	6.5 kHz	"	"	0.301510 V	0.298490 V
" "	400 Hz	"	"	0.301510 V	0.298490 V
3 V	1 MHz	3 V	ACF	3.371200 V	2.628800 V
"	300 kHz	"	"	3.104500 V	2.895500 V
"	100 kHz	"	"	3.021900 V	2.978100 V
"	20 kHz	"	"	3.005320 V	2.994680 V
"	6.5 kHz	"	"	3.005320 V	2.994680 V
"	400 Hz	"	"	3.005320 V	2.994680 V
3 V	100 Hz	3 V	ACS	3.007420 V	2.992580 V
"	45 Hz	"	"	3.017920 V	2.982080 V
"	20 Hz	"	"	3.017920 V	2.982080 V
300 mV	100 Hz	300 mV	ACS	300.7420 mV	299.2580 mV
" "	45 Hz	" "	"	301.7920 mV	298.2180 mV
" "	20 Hz	" "	"	301.7920 mV	298.2180 mV

Table 4-4. AC Frequency Response Test Limits

2. Set the HP 3457A to the AC Voltage function (ACV), the range to 300 mV and the AC Bandwidth to AC Fast. (To change the Bandwidth - Press the SHIFT key, then the Configuration A key. Use the ↓ scroll key to display ACBAND. Enter a number greater than 400 and press the ENT key).

3. Use the Test Record to record the 30 mV (300 mV tenth-scale) readings at 400 Hz, 6.5 KHz, 20 KHz, 100 KHz, 300 KHz and 1 MHz.

4. Set the AC Voltage Standard for an output voltage of 300 mV.

5. Use the Test Record to record the 300 mV readings at 1 MHz, 300 KHz, 100 KHz, 20 KHz, 6.5 KHz and 400 Hz.

AC Voltage Performance Tests Cont'd

6. Set the HP 3457A to the 3 volt range.

7. Use the Test Record to record the 300 mV (3 V tenth-scale) readings at 400 Hz, 6.5 KHz, 20 KHz, 100 KHz, 300 KHZ and 1 MHz.

8. Set the AC Voltage Standard for an output voltage of 3 volts.

9. Use the Test Record to record the 3 V readings at 1 MHz, 300 KHz, 100 KHz, 20 KHz, 6.5KHz and 400 Hz.

10. Set the HP 3457A AC Bandwidth to AC Slow. (Press the SHIFT key, then the Configuration A. Use the ↓ scroll key to display ACBAND. Enter a number less than 400 and press the ENT key).

11. Use the Test Record to record the 3 V readings at 100 Hz, 45 Hz and 20 Hz.

12. Set the AC Voltage Standard for an output voltage of 300 mV.

13. Set the HP 3457A to the 300 mV range.

14. Use the Test Record to record the 300 mV readings at 20 Hz, 45 Hz and 100 Hz.

15. Reduce the output of the AC Voltage Standard and disconnect it from the HP 3457A input terminals.

16. If any of the readings are beyond the limits specified in Table 4-4 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V of this manual for calibration procedures.

DC Current Performance Tests

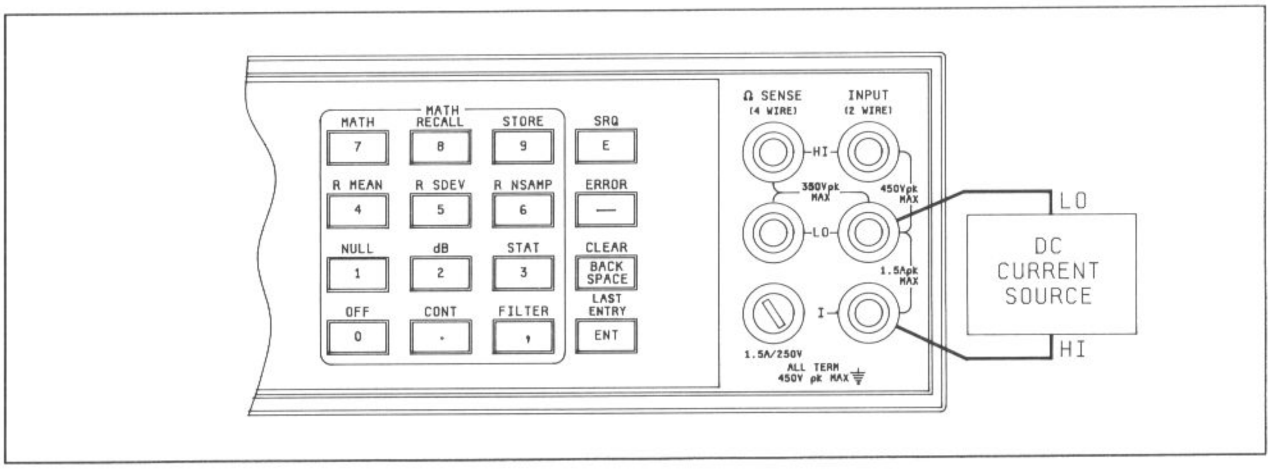

MATH
MATH RECALL
STORE
SRQ
7
8
9
E
R MEAN
R SDEV
R NSAMP
ERROR
4
5
6
—
NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
OFF
CONT
FILTER
LAST ENTRY
0
.
,
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX
LO
DC CURRENT SOURCE
HI

Figure 4-3. DCI Performance Test Connections

DC Current Performance Tests Cont'd

3457A Input	3457A Range	3457A Set Up	90 day limits		1 year limits	
			High	Low	High	Low
Open	300 uA	DCI	+000.0104 uA	-000.0104 uA	+000.0104 uA	-000.0104 uA
Open	3 mA	DCI	+0.000104 mA	-0.000104 mA	+0.000104 mA	-0.000104 mA
Open	30 mA	DCI	+00.00104 mA	-00.00104 mA	+00.00104 mA	-00.00104 mA
Open	300 mA	DCI	+000.0204 mA	-000.0204 mA	+000.0204 mA	-000.0204 mA
Open	1 A	DCI	+0.000604 A	-0.000604 A	+0.000604 A	-0.000604 A
300 uA	300 uA	DCI	300.0704 uA	299.9296 uA	300.1304 uA	299.8696 uA
3 mA	3 mA	DCI	3.000704 mA	2.999296 mA	3.001304 mA	2.998696 mA
30 mA	30 mA	DCI	30.00704 mA	29.99296 mA	30.01304 mA	29.98696 mA
300 mA	300 mA	DCI	300.2304 mA	299.7696 mA	300.2604 mA	299.7396 mA
1 A	1 A	DCI	1.001304 A	0.998696 A	1.001304 A	0.998696 A

Table 4-5. DC Current Offset and Gain Test Limits

4-24. DC Current Function - Offset Test

4-25. Equipment Required. This procedure does not require any test equipment.

1. Set the HP 3457A to the DC Current function (DCI), 300 uA range, and the number of digits displayed (DIGITS DISP) to six.

2. Use the Test Record to record the current offset readings on the 300 uA, 3 mA, 30 mA, 300 mA and 1 A ranges.

3. If any of the offset readings are beyond the limits specified in Table 4-5 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V of this manual for calibration procedures.

4-26. DC Current Function - Gain Test

4-27. Equipment Required. A DC Current Source capable of providing currents of 300 uA, 3 mA, 30 mA (± .007%), 300 mA (± .026%), and 1 A (± .04%) is required for the following procedure.

1. Set the DC Current Source to 300 uA and connect it to the HP 3457A front panel **I** and **LO** input terminals.

2. Set the HP 3457A to the 300 uA range and the number of digits displayed (DIGITS DISP) to six.

3. Use the Test Record to record the full-scale current readings for the 300 uA, 3 mA, 30 mA, 300 mA and 1 A ranges.

4. If any of the full-scale readings are beyond the limits specified in Table 4-5 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V of this manual for calibration procedures.

5. Reduce the output of the DC Current Source and disconnect it from the HP 3457A input terminals.

AC Current Performance Tests

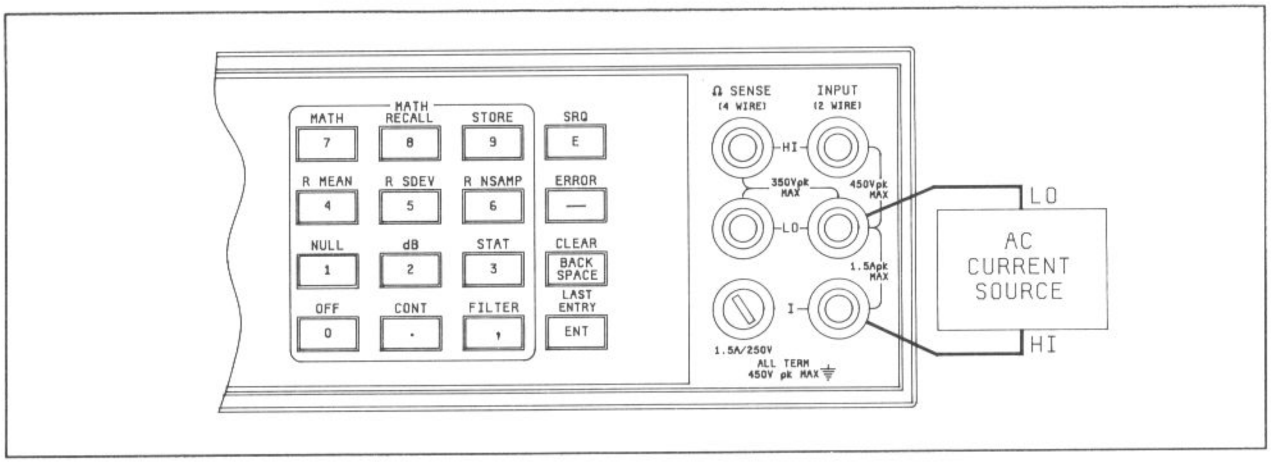

MATH
MATH RECALL
STORE
SRQ
7
8
9
E
R MEAN
R SDEV
R NSAMP
ERROR
4
5
6
—
NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
LAST ENTRY
OFF
CONT
FILTER
0
.
,
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX
LO
AC CURRENT SOURCE
HI

Figure 4-4. ACI Performance Test Connections

4-28. AC Current Function - Gain Test

4-29. Equipment Required, An AC Current Source capable of providing currents of 30 mA (± .14%), 300 mA (± .14%) and 1 A (± .24%) at a frequency between 100 Hz and 20 KHz is required for the following test.

1. Set the AC Current source for an output of 30 mA at a frequency between 100 Hz and 20 KHz and connect it to the HP 3457A front panel **I** and **LO** input terminals.

2. Set the HP 3457A to the 30 mA range and the number of digits displayed (DIGITS DISP) to six.

3. Use the Test Record to record the 30 mA, 300 mA and 1 A full-scale readings.

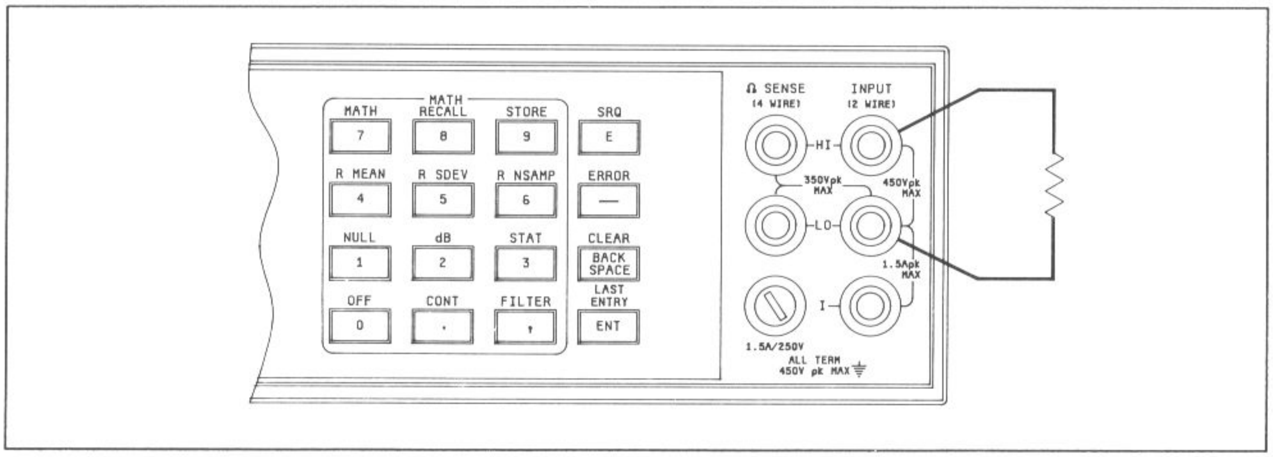
4. If the full-scale readings are beyond the limits specified in Table 4-6 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V of this manual for calibration procedures.

5. Reduce the output of the AC Current Source and disconnect it from the HP 3457A input terminals.

3457A Input	3457A Range	3457A Set Up	90 day limits	
			High	Low
30 mA	30 mA	ACI	30.10300 mA	29.89700 mA
300 mA	300 mA	ACI	301.0300 mA	298.9700 mA
1 A	1 A	ACI	1.005300 A	0.994700 A

Table 4-6. AC Current Test Limits

2-Wire Ohms Performance Tests


MATH
MATH RECALL
STORE
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E
R MEAN
R SDEV
R NSAMP
ERROR
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dB
STAT
CLEAR
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2
3
BACK SPACE
OFF
CONT
FILTER
LAST ENTRY
0
.
↑
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX

Figure 4-5. 2-Wire Ohms Performance Test Connections

4-30. 2-Wire Ohms Function - Offset Test

4-31. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Connect a low thermal short across the HP 3457A front panel HI and LO input terminals.

2. Set the HP 3457A to the 2-Wire Ohms Function, 30 Ohm range and the number of digits displayed (DIGITS DISP) to six.

3. Use the Test Record to record the offset readings for the 30 Ohm, 300 Ohm, 3 Kohm, 30 Kohm, 300 Kohm, 3 Mohm and 30 Mohm ranges.

4. If any of the offset readings are beyond the limits specified in Table 4-7 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

5 . Remove the short from the front panel input terminals.

3457A Input	3457A Range	3457A Set Up	90 day limits	1 year limits
Short	30 ohm	OHM	00.20335 ohm	00.20335 ohm
Short	300 ohm	OHM	000.2035 ohm	000.2035 ohm
Short	3 Kohm	OHM	0.000207 Kohm	0.000207 Kohm
Short	30 Kohm	OHM	00.00027 Kohm	00.00027 Kohm
Short	300 Kohm	OHM	000.0010 Kohm	000.0010 Kohm
Short	3 Mohm	OHM	0.000014 Mohm	0.000014 Mohm
Short	30 Mohm	OHM	00.00083 Mohm	00.00083 Mohm

Table 4-7. 2-Wire Ohms Offset Test Limits

2-Wire Ohms Performance Tests Cont'd

4-32. 2-Wire Ohms Function - Gain Test

4-33. Equipment Required. Resistance Standards of 30 Ohms (± .2%), 300 Ohms (.02%), 3 Kohms (± .003%) 30 Kohms (± .001%), 300 Kohms (± .001%) 3 Mohms (± .001%), and 30 Mohms (± .009%) are required for this procedure.

1.Set the HP 3457A to the 2-wire ohms function (OHM) and the number of digits displayed (DIGITS DISP) to six.

2. Connect the Resistance Standard to the HP 3457A front panel HI and LO input terminals. (The connecting wires should be as short as possible to reduce lead resistance).

3. Use the Test Record to record the 30 Ohm, 300 Ohm, 3 Kohm, 30 Kohm, 300 Kohm, 3 Mohm and 30 Mohm readings.

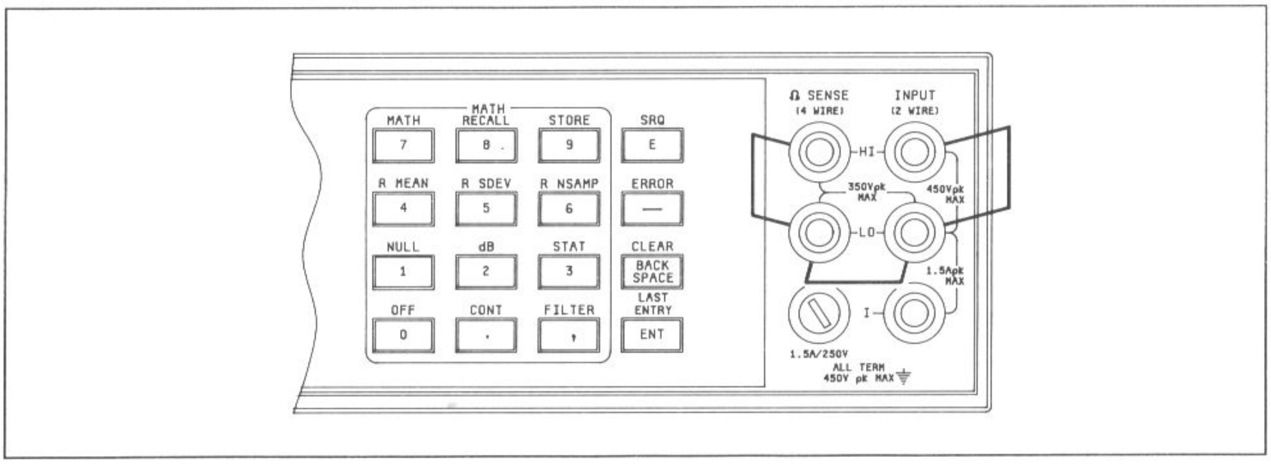
4. If any of the readings are beyond the limits specified in Table 4-8 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

5. Remove the Resistance standard from the HP 3457A front panel input terminals.

3457A Input	3457A Range	3457A Set Up	90 day limits		1 year limits	
			High	Low	High	Low
30 ohm	30 ohm	OHM	30.20530 ohm	29.79470 ohm	30.20560 ohm	29.795440ohm
300 ohm	300 ohm	OHM	300.2170 ohm	299.7830 ohm	300.2200 ohm	299.7800 ohm
3 Kohm	3 Kohm	OHM	3.000312 Kohm	2.999688 Kohm	3.000357 Kohm	2.999643 Kohm
30 Kohm	30 Kohm	OHM	30.00132 Kohm	29.99868 Kohm	30.00177 Kohm	29.99823 Kohm
300 Kohm	300 Kohm	OHM	300.0130 Kohm	299.9870 Kohm	300.0160 Kohm	299.9840 Kohm
3 Mohm	3 Mohm	OHM	3.000179 Mohm	2.999821 Mohm	3.000209 Mohm	2.999791 Mohm
30 Mohm	30 Mohm	OHM	30.00833 Mohm	29.99167 Mohm	30.01283 Mohm	29.98717 Mohm

Table 4-8. 2-Wire Ohms Gain Test Limits

4-Wire Ohms Performance Tests


MATH
MATH RECALL
STORE
SRQ
7
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9
E
R MEAN
R SDEV
R NSAMP
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4
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—
NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
LAST ENTRY
OFF
CONT
FILTER
0
.
↑
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX

Figure 4-6. 4-Wire Ohms Offset Performance Test Connections

4-Wire Ohms Performance Tests Cont'd

4-34. 4-Wire Ohms Function - Offset Test

4-35. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Set the HP 3457A to the 4-Wire Ohms Function (OHMF) and the number of digits displayed (DIGITS DISP) to six.

2. Short the front panel input terminals of the HP 3457A as shown in Figure 4-6.

3. Use the Test Record to record the offset readings of the 30 Ohm, 300 Ohm, 3 Kohm, 30 Kohm, 300 Kohm, 3 Mohm, and 30 Mohm ranges.

4. If any of the offset readings are beyond the limits specified in Table 4-9 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V of this manual for calibration procedures.

5. Remove the short from the front panel input terminals.

3457A Input	3457A Range	3457A Set Up	90 day limits	1 year limits
Short	30 ohm	OHMF	00.00335 ohm	00.00335 ohm
Short	300 ohm	OHMF	000.0035 ohm	000.0035 ohm
Short	3 Kohm	OHMF	0.000007 Kohm	0.000007 Kohm
Short	30 Kohm	OHMF	00.00007 Kohm	00.00007 Kohm
Short	300 Kohm	OHMF	000.0008 Kohm	000.0008 Kohm
Short	3 Mohm	OHMF	0.000014 Mohm	0.000014 Mohm
Short	30 Mohm	OHMF	00.00083 Mohm	00.00083 Mohm

Table 4-9. 4-Wire Ohms Offset Test Limits

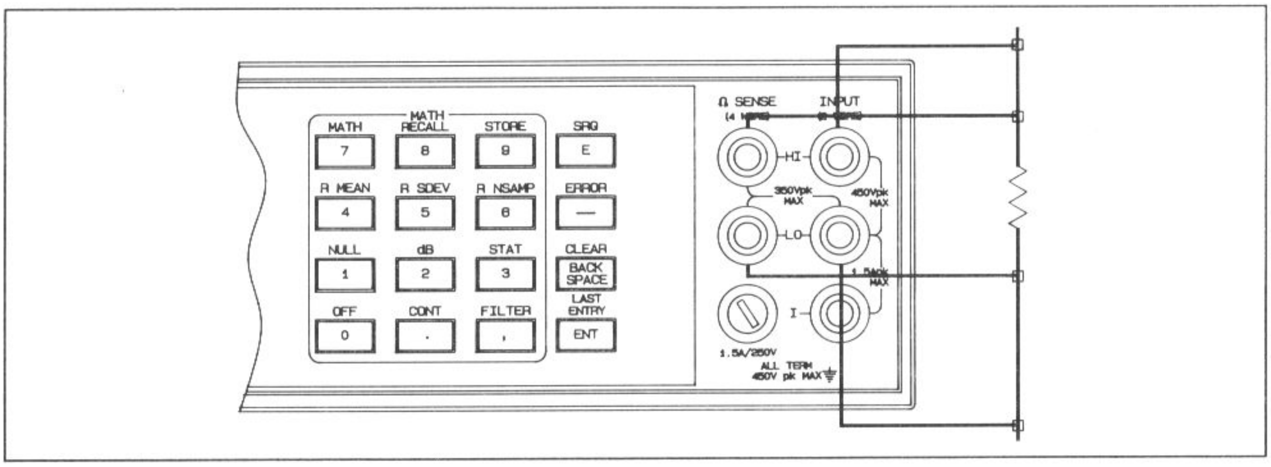

MATH
MATH RECALL
STORE
SRQ
7
8
9
E
R MEAN
R SDEV
R NSAMP
ERROR
4
5
6
—
NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
OFF
CONT
FILTER
LAST ENTRY
0
.
,
ENT
Ω SENSE
INPUT
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX

Figure 4-7. 4-Wire Ohms Gain Performance Test Connections

4-Wire Ohms Performance Tests Cont'd

4-36. 4-Wire Ohms Function - Gain Test

4-37. Equipment Required. Resistance Standards of 30 Ohms (± .004%), 300 Ohms (.002%), 3 Kohms (± .001%) 30 Kohms (± .001%), 300 Kohms (± .001%), 3 Mohms (± .001%) and 30 Mohms (± .009%) are required for this procedure.

1. Set the HP 3457A to the 4-Wire ohms function (OHMF) and the number of digits displayed (DIGITS DISP) to six.

2. Connect the appropriate Resistance Standard to the HP 3457A front panel input terminals as shown in Figure 4-7.

3. Use the Test Record to record the resistance readings for the 30 Ohm, 300 Ohm, 3 Kohm, 30 Kohm, 300 Kohm, 3 Mohm and 30 Mohm ranges.

4. If any of the readings are beyond the limits specified in Table 4-10 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

5. Remove the Resistance Standard from the HP 3457A front panel input terminals.

3457A Input	3457A Range	3457A Set Up	90 day limits		1 year limits	
			High	Low	High	Low
30 ohm	30 ohm	OHMF	30.00530 ohm	29.99470 ohm	30.00560 ohm	29.99440 ohm
300 ohm	300 ohm	OHMF	300.0170 ohm	299.9830 ohm	300.0200 ohm	299.9800 ohm
3 Kohm	3 Kohm	OHMF	3.000112 Kohm	2.999888 Kohm	3.000157 Kohm	2.999843 Kohm
30 Kohm	30 Kohm	OHMF	30.00112 Kohm	29.99888 Kohm	30.00157 Kohm	29.99844 Kohm
300 Kohm	300 Kohm	OHMF	300.0128 Kohm	299.9872 Kohm	300.0158 Kohm	299.9842 Kohm
3 Mohm	3 Mohm	OHMF	3.000179 Mohm	2.999821 Mohm	3.000209 Mohm	2.999791 Mohm
30 Mohm	30 Mohm	OHMF	30.00833 Mohm	29.99167 Mohm	30.01283 Mohm	29.98717 Mohm

Table 4-10. 4-Wire Ohms Gain Test Limits

Frequency Counter Performance Tests

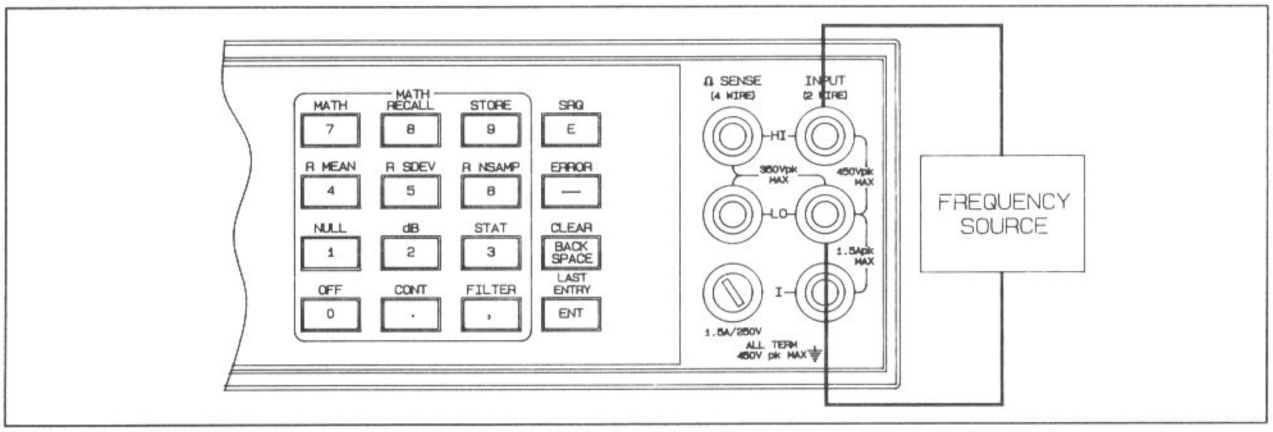

MATH
RECALL
MATH
7
8
STORE
9
SRQ
E
R MEAN
4
R SDEV
5
R NSAMP
6
ERROR
—
NULL
1
dB
2
STAT
3
CLEAR
BACK SPACE
OFF
0
CONT
.
FILTER
,
LAST ENTRY
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX
FREQUENCY SOURCE

Figure 4-8. Frequency Counter Performance Test Connections

Frequency Counter Performance Tests Cont'd

4-38. Frequency Counter - Accuracy Test

4-39. Equipment Required. A Frequency Source capable of providing a 20 Hz (± .016%) and a 1 MHz (± .003%) sine-wave signal is required for this procedure.

1. Set the HP 3457A to the Frequency Function (FREQ).

2. Set the Frequency Standard for a 1 volt, 20 Hz sine-wave output signal and connect it to the HI and LO input terminals of the HP 3457A.

3. Use the Test Record to record the frequency readings at 20 Hz and 1 MHz.

4. If either of the readings are beyond the limits specified, the instrument should be calibrated or repaired. Refer to Section V of this manual for calibration procedures.

Rear Input Performance Tests (Standard Instrument)

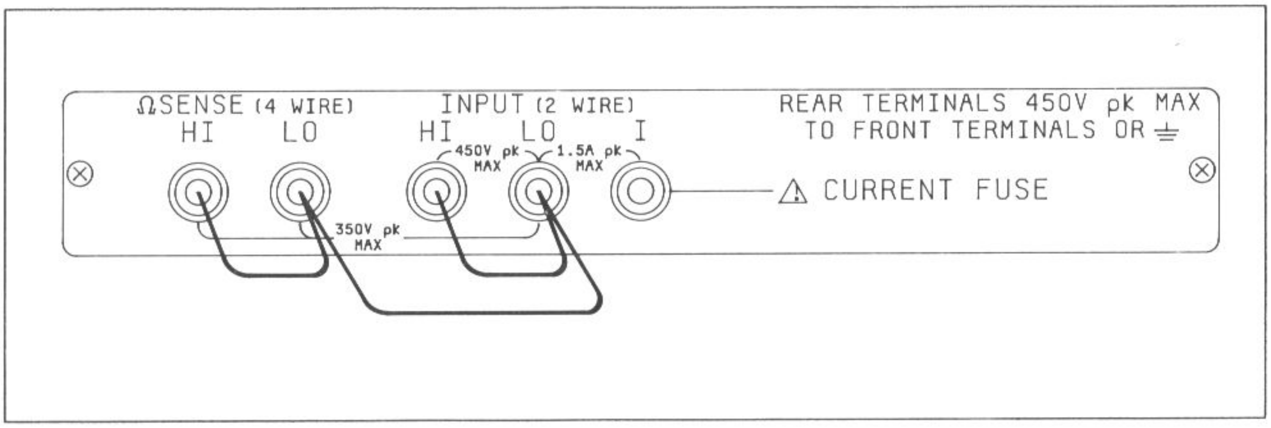


Figure 4-9. Standard Instrument Rear Input Performance Test Connections

4-40. Preliminary Steps

1. Short the Rear Input HI and LO terminals and the Ω Sense HI and LO terminals as shown in Figure 4-9.

2. Select the Rear Terminal Input. (Press the TERM configuration key, enter the number 2 and press the ENT key.

4-41. DC Voltage Function - Rear Terminal Offset Test

4-42. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Set the HP 3457A to the DC Voltage function (DCV) and the number of digits displayed (DIGITS DISP) to six.

Rear Input Performance Tests (Standard Instrument) Cont'd

2. Test the HP 3457A input offset on the 300 V, 30 V, 3 V, 300 mV and 30 mV ranges and record the reading of each range on the Test Record provided at the end of this section. Begin with the 300 V range to allow any thermal voltages which might affect the readings on the lower ranges to dissipate.

3. If any of the offset readings are beyond the limits specified in Table 4-11 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

3457A Input	3457A Range	3457A Set Up	90 day limits		1 year limits	
			High	Low	High	Low
Short	300 V	DCV	+000.0007 V	-000.0007 V	+000.0007 V	-000.0007 V
Short	30 V	DCV	+ 00.00020 V	- 00.00020 V	+ 00.00020 V	- 00.00020 V
Short	3 V	DCV	+ 0.000007 V	- 0.000007 V	+ 0.000007 V	- 0.000007 V
Short	300 mV	DCV	+000.0040 mV	-000.0040 mV	+000.0040 mV	-000.0040 mV
Short	30 mV	DCV	+ 00.00385 mV	- 00.00385 mV	+ 00.00385 mV	- 00.00385 mV

Table 4-11. DC Voltage Offset Test Limits (Rear Terminals)

4-43. DC Current Function - Rear Terminal Offset Test

4-44. Equipment Required. This procedure does not require any test equipment.

1. Set the HP 3457A to the DC Current function (DCI), 300 uA range, and the number of digits displayed (DIGITS DISP) to six.

2. Use the Test Record to record the current offset readings on the 300 uA, 3 mA, 30 mA, 300 mA and 1 A ranges.

3. If any of the offset readings are beyond the limits specified in Table 4-12 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

3457A Input	3457A Range	3457A Set Up	90 day limits		1 year limits	
			High	Low	High	Low
Open	300 uA	DCI	+000.0104 uA	-000.0104 uA	+000.0104 uA	-000.0104 uA
Open	3 mA	DCI	+0.000104 mA	-0.000104 mA	+0.000104 mA	-0.000104 mA
Open	30 mA	DCI	+00.00104 mA	-00.00104 mA	+00.00104 mA	-00.00104 mA
Open	300 mA	DCI	+000.0204 mA	-000.0204 mA	+000.0204 mA	-000.0204 mA
Open	1 A	DCI	+0.000604 A	-0.000604 A	+0.000604 A	-0.000604 A

Table 4-12. DC Current Offset Test Limits (Rear Terminals)

4-45. 2-Wire Ohms Function - Rear Terminal Offset Test

4-46. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Set the HP 3457A to the 2-Wire Ohms Function, 30 Ohm range and the number of digits displayed (DIGITS DISP) to six.

Rear Input Performance Tests (Standard Instrument) Cont'd

2. Use the Test Record to record the offset readings for the 30 Ohm, 300 Ohm, 3 Kohm, 30 Kohm, 300 Kohm, 3 Mohm and 30 Mohm ranges.

3. If any of the offset readings are beyond the limits specified in Table 4-13 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

3457A Input	3457A Range	3457A Set Up	90 day limits	1 year limits
Short	30 ohm	OHM	00.20335 ohm	00.20335 ohm
Short	300 ohm	OHM	000.2035 ohm	000.2035 ohm
Short	3 Kohm	OHM	0.000207 Kohm	0.000207 Kohm
Short	30 Kohm	OHM	00.00027 Kohm	00.00027 Kohm
Short	300 Kohm	OHM	000.0010 Kohm	000.0010 Kohm
Short	3 Mohm	OHM	0.000014 Mohm	0.000014 Mohm
Short	30 Mohm	OHM	00.00083 Mohm	00.00083 Mohm

Table 4-13. 2-Wire Ohms Offset Test Limits (Rear Terminals)

4-47. 4-Wire Ohms Function - Offset Test

4-48. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Set the HP 3457A to the 4-Wire Ohms Function (OHMF) and the number of digits displayed (DIGITS DISP) to six.

2. Use the Test Record to record the offset readings of the 30 Ohm, 300 Ohm, 3 Kohm, 30 Kohm, 300 Kohm, 3 Mohm, and 30 Mohm ranges.

3. If any of the offset readings are beyond the limits specified in Table 4-14 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

3457A Input	3457A Range	3457A Set Up	90 day limits	1 year limits
Short	30 ohm	OHMF	00.00335 ohm	00.00335 ohm
Short	300 ohm	OHMF	000.0035 ohm	000.0035 ohm
Short	3 Kohm	OHMF	0.000007 Kohm	0.000007 Kohm
Short	30 Kohm	OHMF	00.00007 Kohm	00.00007 Kohm
Short	300 Kohm	OHMF	000.0008 Kohm	000.0008 Kohm
Short	3 Mohm	OHMF	0.000014 Mohm	0.000014 Mohm
Short	30 Mohm	OHMF	00.00083 Mohm	00.00083 Mohm

Table 4-14. 4-Wire Ohms Offset Test Limits (Rear Terminals)

Rear Input Performance Tests (44491A General Purpose Relay Assy)

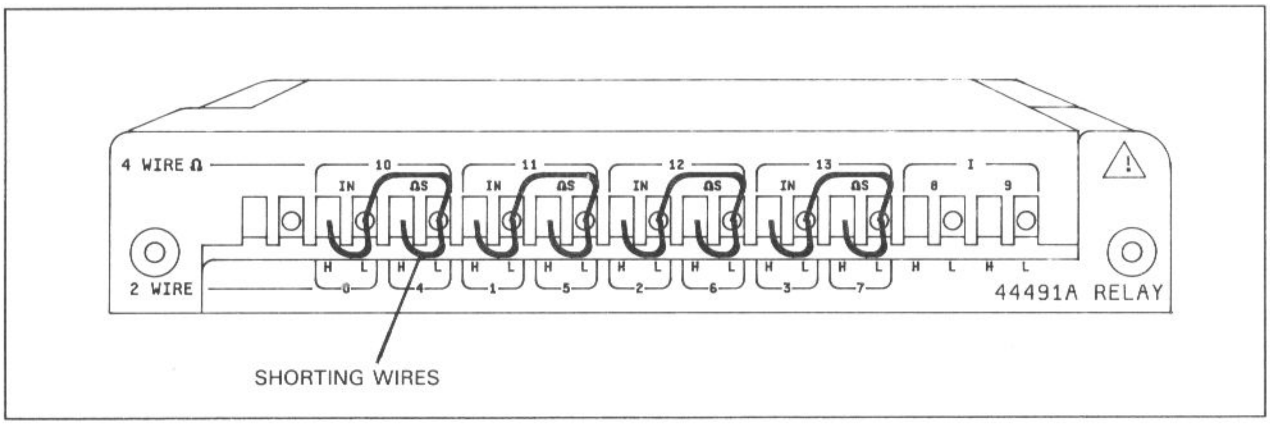


Figure 4-10. HP 44491A Terminal Block Assembly Connections

4-49. Preliminary Steps

1. Short the Rear Input HI and LO terminals and the Ω Sense HI and LO terminals as shown in Figure 4-9.

2. Select the Rear Terminal Input. (Press the TERM configuration key, enter the number 2 and press the ENT key.

NOTE

The 44491A Relay Assembly and the 3457A Multimeter must have been calibrated as a unit for these tests to apply. Calibration procedures are provided in Section V of this manual.

4-50. DC Voltage Function - 44491A Offset Test

4-51. Equipment Required. Low thermal (copper) shorting wires are required for this procedure.

1. Set the HP 3457A to the DC Voltage function (DCV) and the number of digits displayed (DIGITS DISP) to six.

2. Close channel 0. (Press the CHAN configuration key, enter the number 0 and press the ENT key).

3. Test the input offset on the 300 V, 30 V, 3 V, 300 mV and 30 mV ranges and record the reading of each range on the Test Record provided at the end of this section. Begin with the 300 V range to allow any thermal voltages which might affect the readings on the lower ranges to dissipate.

4. Test the HP 3457A input offset on channels 0 through 7 with the instrument set to the 30 mV range. Record the reading of each channel on the Test Record provided at the end of this section.

5. If any of the offset readings are beyond the limits specified in Table 4-15 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

Rear Input Performance Tests (44491A Relay Assy.) Cont'd

3457A Input	3457A Range	3457A Set Up	Test Limits High	Test Limits Low
Short	300 V	DCV	+000.0007 V	-000.0007 V
Short	30 V	DCV	+ 00.00020 V	- 00.00020 V
Short	3 V	DCV	+ 0.000010 V	- 0.000010 V
Short	300 mV	DCV	+000.0070 mV	-000.0070 mV
Short	30 mV	DCV	+ 00.00685 mV	- 00.00685 mV

Table 4-15. DC Voltage Offset Test Limits (44491A)

4-52. 2-Wire Ohms Function - 44491A Offset Test Limits

4-53. Equipment Required. Low thermal (copper) shorting wires are required for this procedure.

1. Set the HP 3457A to the 2-Wire Ohms Function, 30 Mohm range. Set the offset compensation (OFFSET COMP) on, and the number of digits displayed (DIGITS DISP) to six.

2. Close channel 0. (Press the CHAN configuration key, enter the number 0 and press the ENT key).

3. Use the Test Record to record the offset readings for the 30 Mohm, 3 Mohm, 300 Kohm, 30 Kohm, 3 Kohm, 300 Ohm and 30 Ohm ranges.

4. Test the ohms offset on channels 0 through 7 with the instrument set to the 30 Ohm range. Record the reading of each channel on the Test Record provided at the end of this section.

5. If any of the offset readings are beyond the limits specified in Table 4-16 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

3457A Input	3457A Range	3457A Set Up	Test Limits
Short	30 ohm	OHM	02.20635 ohm
Short	300 ohm	OHM	002.2065 ohm
Short	3 Kohm	OHM	0.002210 Kohm
Short	30 Kohm	OHM	00.00230 Kohm
Short	300 Kohm	OHM	000.0033 Kohm
Short	3 Mohm	OHM	0.000019 Mohm
Short	30 Mohm	OHM	00.00086 Mohm

Table 4-16. 2-Wire Ohms Offset Test Limits (44491A)

4-54. 4-Wire Ohms Function - 44491A Offset Test Limits

4-55. Equipment Required. Low thermal (copper) shorting wires are required for this procedure.

1. Set the HP 3457A to the 4-Wire Ohms Function (OHMF). Set the offset compensation (OFFSET COMP) on, and the number of digits displayed (DIGITS DISP) to six.

Rear Input Performance Tests (44491A Relay Assy.) Cont'd

2. Close channel 10. (Press the CHAN configuration key, enter the number 10 and press the ENT key).

3. Use the Test Record to record the offset readings of the 30 Ohm, 300 Ohm, 3 Kohm, 30 Kohm, 300 Kohm, 3 Mohm, and 30 Mohm ranges.

4. If any of the offset readings are beyond the limits specified in Table 4-17 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

3457A Input	3457A Range	3457A Set Up	Test Limits
Short	30 ohm	OHMF	00.00635 ohm
Short	300 ohm	OHMF	000.0065 ohm
Short	3 Kohm	OHMF	0.000010 Kohm
Short	30 Kohm	OHMF	00.00010 Kohm
Short	300 Kohm	OHMF	000.0011 Kohm
Short	3 Mohm	OHMF	0.000017 Mohm
Short	30 Mohm	OHMF	00.00086 Mohm

Table 4-17. 4-Wire Ohms Offset Test Limits (44491A)

4-56. DC Current Function - 44491A Offset Test Limits

4-57. Equipment Required. This procedure does not require any test equipment.

1. Set the HP 3457A to the DC Current function (DCI), 300 uA range, and the number of digits displayed (DIGITS DISP) to six.

2. Use the Test Record to record the current offset readings on the 300 uA, 3 mA, 30 mA, 300 mA and 1 A ranges.

3. If any of the offset readings are beyond the limits specified in Table 4-18 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

3457A Input	3457A Range	3457A Set Up	Test Limits High	Test Limits Low
Open	300 uA	DCI	+000.0104 uA	-000.0104 uA
Open	3 mA	DCI	+0.000104 mA	-0.000104 mA
Open	30 mA	DCI	+00.00104 mA	-00.00104 mA
Open	300 mA	DCI	+000.0204 mA	-000.0204 mA
Open	1 A	DCI	+0.000604 A	-0.000604 A

Table 4-18. DC Current Offset Test Limits (44491A)

Rear Input Performance Tests (44492A 10 Channel Multiplex Assy)

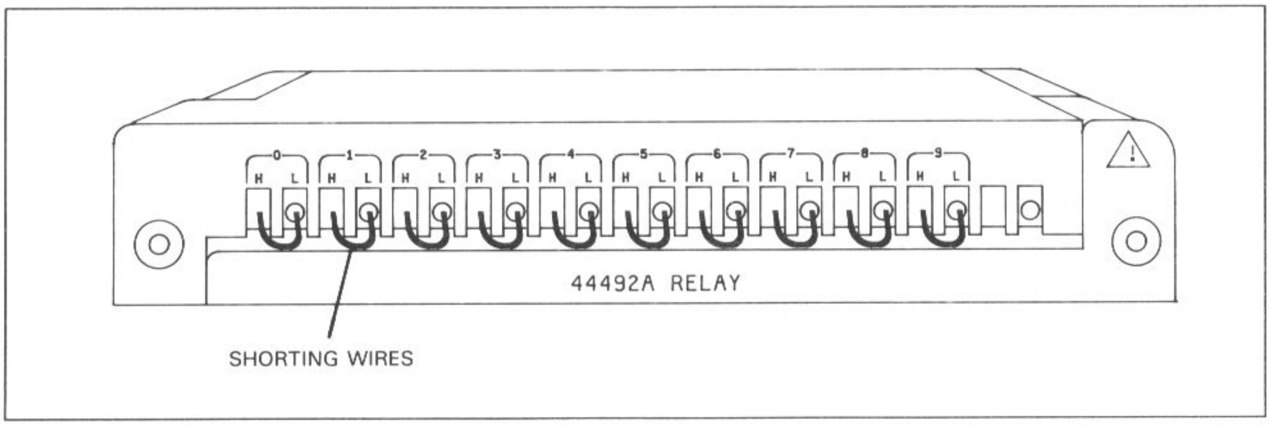


Figure 4-11. HP 44492A Terminal Block Assembly Connections

4-58. Preliminary Steps

1. Connect shorting wires to the inputs of the Terminal Block assembly as shown in Figure 4-11.

2. Select the Scanner Input. (Press the TERM configuration key, enter the number 2 and press the ENT key).

NOTE

The 44492A Multiplexer Assembly and the 3457A Multimeter must have been calibrated as a unit for these tests to apply. Calibration procedures are provided in Section V of this manual.

4-59. DC Voltage Function - 44492A Offset Test

4-60. Equipment Required. A low thermal (copper) shorting wire is required for this procedure.

1. Set the HP 3457A to the DC Voltage function (DCV) and the number of digits displayed (DIGITS DISP) to six.

2. Close channel 0. (Press the CHAN configuration key, enter the number 0 and press the ENT key).

3. Test the HP 3457A input offset on the 300 V, 30 V, 3 V, and 300 mV ranges and record the reading of each range on the Test Record provided at the end of this section. Begin with the 300 V range to allow any thermal voltages which might affect the readings on the lower ranges to dissipate.

4. Test the HP 3457A input offset on channels 0 through 9 with the instrument set to the 30 mV range. Record the reading of each channel on the Test Record provided at the end of this section.

5. If any of the offset readings are beyond the limits specified in Table 4-19 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V of this manual for calibration procedures.

Rear Input Performance Tests (44492A Multiplex Assy.) Cont'd

3457A Input	3457A Range	3457A Set Up	Test Limits High	Low
Short	300 V	DCV	+000.0007 V	-000.0007 V
Short	30 V	DCV	+ 00.00020 V	- 00.00020 V
Short	3 V	DCV	+ 0.000010 V	- 0.000010 V
Short	300 mV	DCV	+000.0070 mV	-000.0070 mV

Table 4-19. DC Voltage Offset Test Limits (44492A)

4-61. 2-Wire Ohms Function - 44492A Offset Test Limits

4-62. Equipment Required. A low thermal (copper) shorting wire is required for this procedure.

1. Set the HP 3457A to the 2-Wire Ohms Function, 30 Mohm range, set the offset compensation (OFFSET COMP) on, and the number of digits displayed (DIGITS DISP) to six.

2. Close channel 0. (Press the CHAN configuration key, enter the number 0 and press the ENT key).

3. Use the Test Record to record the offset readings for the 30 Mohm, 3 Mohm, 300 Kohm, 30 Kohm, 3 Kohm and 300 Ohm ranges.

4. Test the ohms offset on channels 0 through 9 with the instrument set to the 300 Ohm range. Record the reading of each channel on the Test Record provided at the end of this section.

5. If any of the offset readings are beyond the limits specified in Table 4-20 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V of this manual for calibration procedures.

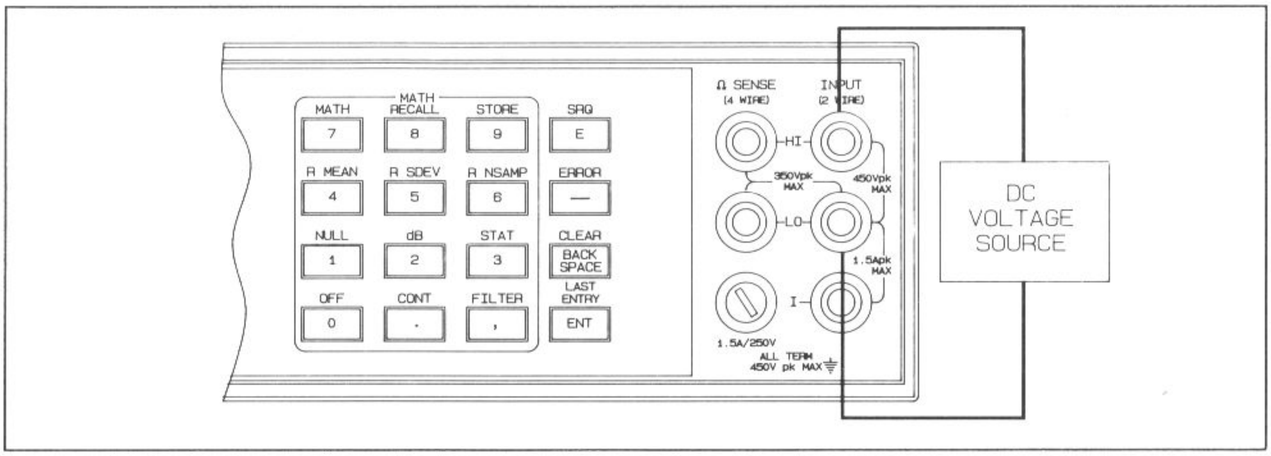
3457A Input	3457A Range	3457A Set Up	Test Limits
Short	300 ohm	OHM	004.2065 ohm
Short	3 Kohm	OHM	0.004210 Kohm
Short	30 Kohm	OHM	00.00430 Kohm
Short	300 Kohm	OHM	000.0053 Kohm
Short	3 Mohm	OHM	0.000021 Mohm
Short	30 Mohm	OHM	00.00086 Mohm

Table 4-20. 2-Wire Ohms Offset Test Limits (44492A)

4-63. OPERATIONAL VERIFICATION TESTS

4-64. The Operational Verification Tests are an abbreviated version of the Performance Tests. The purpose of these tests is to provide a more rapid means of testing the performance of the HP 3457A. The Operational Verification Tests are designed to provide a 90% confidence that the instrument is operational and that it meets its specifications.

DC Voltage Operational Verification Tests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MATH RECALL
8
STORE
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SRQ
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R MEAN
4
R SDEV
5
R NSAMP
6
ERROR
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NULL
1
dB
2
STAT
3
CLEAR
BACK SPACE
OFF
0
CONT
.
FILTER
,
LAST ENTRY
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
LO
I
350Vpk MAX
450Vpk MAX
1.5Apk MAX
1.5A/250V
ALL TERM 450V pk MAX
DC VOLTAGE SOURCE

Figure 4-12. DCV Operational Verification Test Connections

NOTE

The temperature of the environment where these tests are to be performed must be within ±5° C of the temperature where the instrument was calibrated. The instrument was calibrated at the factory in an area with a temperature of 20° C (± 1° C).

4-65. Preliminary Steps

1. Turn the instrument ON and allow a one hour warm-up period.

2. Be certain all external inputs are disconnected from the HP 3457A. Run the TEST routine. The test result must read "SELF TEST OK". If the display shows "TEST FAILED", the instrument probably needs repair.

3. Run the AUTO CAL routine. (Press the AUTO CAL key, enter the number 1 and press the ENT key).

4-66. DC Voltage Function - Offset Test

4-67. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Connect a low thermal short across the Front Panel HI and LO Input Terminals.

DC Voltage Operational Verification Tests Cont'd

2. Set the HP 3457A to the DC Voltage function (DCV) and the number of digits displayed (DIGITS DISP) to six.

3. Test the HP 3457A input offset on the 30 V, 3 V, and 300 mV ranges and record the reading of each range on the Test Record provided at the end of this section. Begin with the 30 V range to allow any thermal voltages which might affect the readings on the lower ranges to dissipate.

4. If any of the offset readings are beyond the limits specified in Table 4-21 and on the Test Record, the instrument should be calibrated. Refer to Section V of this manual for calibration procedures.

5. Remove the short from the Front Panel Input Terminals.

4-68. DC Voltage Function - Gain Test

4-69. Equipment Required. A set of low thermal cables and a DC Voltage Standard capable of providing 300 mV (± .0012%), 3 V (± .0006%) and 30 V (± .0013%) is required for this test.

1. Set the output of the DC Voltage Standard to 300 mV and connect it to the HP 3457A front panel HI and LO Input Terminals.

2. Use the Test Record to record the full-scale readings for the 300 mV, 3 V, and 30 V ranges. Begin with the 30 V range.

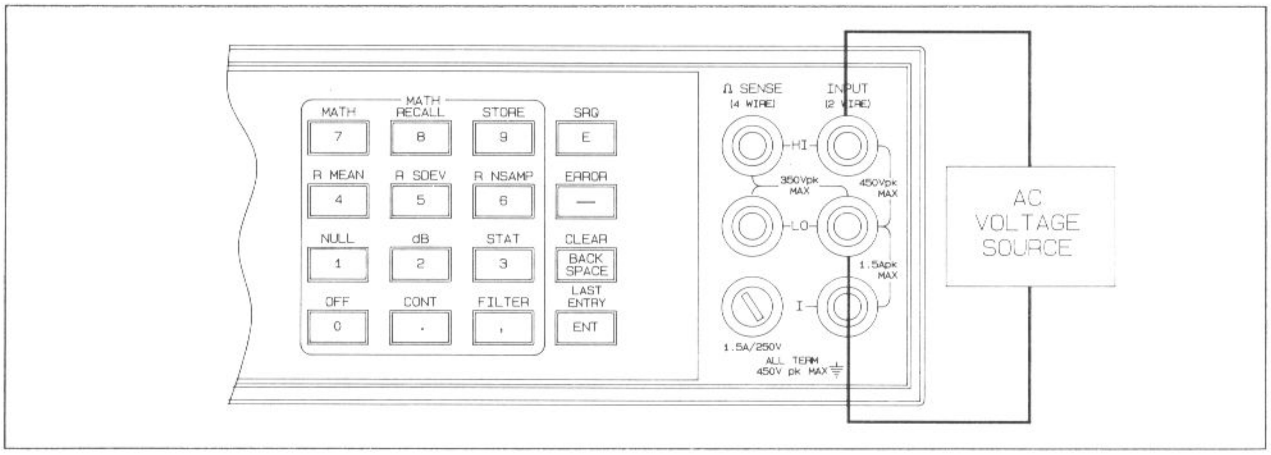
3. If any of the full-scale readings are beyond the limits specified in Table 4-21 and on the Test Record, the instrument should be calibrated. Refer to Section V of this manual for calibration procedures.

4. Reduce the output of the Voltage Standard to 0 volts and disconnect it from the HP 3457A.

3457A Input	3457A Range	3457A Set Up	90 day limits		1 year limits	
			High	Low	High	Low
Short	30 V	DCV	+ 00.00020 V	- 00.00020 V	+ 00.00020 V	- 00.00020 V
Short	3 V	DCV	+ 0.000007 V	- 0.000007 V	+ 0.000007 V	- 0.000007 V
Short	300 mV	DCV	+000.0040 mV	-000.0040 mV	+000.0040 mV	-000.0040 mV
300 mV	300 mV	DCV	+300.0115 mV	+299.9885 mV	+300.0145 mV	+299.9855 mV
3 V	3 V	DCV	+ 3.000058 V	+ 2.999942 V	+ 3.000082 V	+ 2.999918 V
30 V	30 V	DCV	+ 30.00125 V	+ 29.99875 V	+ 30.00140 V	+ 29.99860 V

Table 4-21. DC Voltage Test Limits

AC Voltage Operational Verification Tests


MATH
MATH RECALL
STORE
SRQ
7
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E
R MEAN
R SDEV
R NSAMP
ERROR
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NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
OFF
CONT
FILTER
LAST ENTRY
0
.
,
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
LO
I
350Vpk MAX
450Vpk MAX
1.5Apk MAX
1.5A/250V
ALL TERM 450V pk MAX
AC VOLTAGE SOURCE

Figure 4-13. ACV Operational Verification Test Connections

4-70. AC Voltage Function - Gain Test

4-71. Equipment Required. An AC Signal Source capable of providing sine-wave voltages of 300 mV, 3 V, and 30 V (± 0.05%) at a frequency of 1 KHz is required for the following procedure.

1. Set the HP 3457A to the AC Voltage function (ACV).

2. Connect the AC Signal Source to the HP 3457A front panel HI and LO input terminals. Set the Signal Source for an output voltage of 30 V at a frequency of 1 KHz.

3. Use the Test Record to record the 300 mV, 3 V and 30 V full-scale readings beginning with the 30 V range.

4. If any of the gain readings are beyond the limits specified in Table 4-22 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

3457A Input	Input Freq.	3457A Range	3457A Set Up	90 day limits High	Low
300 mV	1 kHz	300 mV	ACV	300.5020 mV	299.4980 mV
3 V	1 kHz	3 V	ACV	3.005100 V	2.994900 V
30 V	1 kHz	30 V	ACV	30.05020 V	29.94980 V

Table 4-22. AC Gain Test Limits

4-72. AC Voltage Function - Frequency Response Test

4-73. Equipment Required. An AC Signal Source capable of providing sine-wave voltages of 300 mV and 3 V (±.2%) at 20 KHz, 300 mV and 3 V (±.1%) at 100 Hz and 300 mV and 3 V (±.3%) at 20 Hz is required for this test.

1. Connect the AC Signal Source to the HP 3457A front panel HI and LO input terminals. Set the AC Voltage Standard for an output voltage of 300 mV at a frequency of 20 KHz.

AC Voltage Operational Verification Tests Cont'd

2. Set the HP 3457A to the AC Voltage function (ACV), the range to 3 V and the AC Bandwidth to AC Fast. *(To change the Bandwidth - Press the SHIFT key, then the NPLC / A configuration key. Use the ↓ scroll key to display ACBAND. Enter a number greater than 400 and press the ENT key).*

3. Use the Test Record to record the 3 V 1/10 full-scale reading at 20 KHz.

4. Set the AC Voltage Standard for an output of 3 V at 20 KHz. Use the Test Record to record the 3 V, 20 KHz full-scale reading.

5. Set the HP 3457A AC Bandwidth to AC Slow. *(Press the Blue SHIFT key then the NPLC / A configuration key. Use the ↓ scroll key to display ACBAND. Enter a number smaller than 400 and press the ENT key).*

6. Set the AC Voltage Standard for an output of 3 V at 100 Hz. Use the Test Record to record the 3 V, 100 Hz full-scale reading.

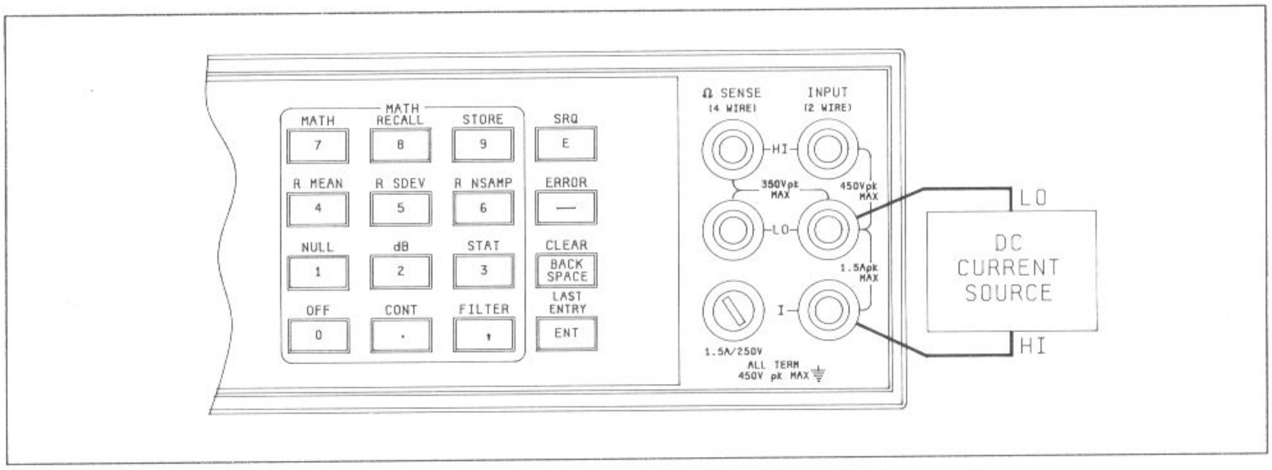
7. Set the AC Voltage Standard for an output of 3 V at 20 Hz. Use the Test Record to record the 3 V, 20 Hz full-scale reading.

8. If any of the readings are beyond the limits specified in Table 4-23 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

3457A Input	Input Freq.	3457A Range	3457A Set Up	90 day limits High	Low
300 mV	20 kHz	3 V	ACF	0.301510 V	0.298490 V
3 V	20 kHz	3 V	ACF	3.005320 V	2.994680 V
3 V	100 Hz	3 V	ACS	3.007420 V	2.992580 V
3 V	20 Hz	3 V	ACS	3.017920 V	2.982080 V

Table 4-23. AC Frequency Response Test Limits

DC Current Operational Verification Tests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MATH RECALL
STORE
SRQ
7
8
9
E
R MEAN
R SDEV
R NSAMP
ERROR
4
5
6
—
NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
OFF
CONT
FILTER
LAST ENTRY
0
.
↑
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX
LO
DC CURRENT SOURCE
HI

Figure 4-14. DCI Operational Verification Test Connections

DC Current Operational Verification Tests Cont'd

3457A Input	3457A Range	3457A Set Up	90 day limits		1 year limits	
			High	Low	High	Low
Open	3 mA	DCI	+0.000104 mA	-0.000104 mA	+0.000104 mA	-0.000104 mA
Open	1 A	DCI	+00.00604 mA	-00.00604 mA	+00.00604 mA	-00.00604 mA
3 mA	3 mA	DCI	3.000704 mA	2.999296 mA	3.001304 mA	2.998696 mA
300 mA	1 A	DCI	0.300814 A	0.299186 A	0.300844 A	0.299156 A

Table 4-24. DC Current Test Limits

4-74. DC Current Function - Offset Test

4-75. Equipment Required. This procedure does not require any test equipment.

1. Set the HP 3457A to the DC Current function (DCI), 3 mA range, and the number of digits displayed (DIGITS DISP) to six.

2. Use the Test Record to record the current offset readings on the 3 mA and 1 A ranges.

3. If either of the offset readings are beyond the limits specified in Table 4-24 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

4-76. DC Current Function - Gain Test

4-77. Equipment Required. A DC Current Source capable of providing currents of 3 mA and 300 mA (± .007%) is required for the following procedure.

1. Set the DC Current Source for an output of 0 mA and connect it to the HP 3457A front panel **I** and **LO** input terminals.

2. Set the HP 3457A to the 3 mA range and the number of digits displayed (DIGITS DISP) to six. Set the DC Current Source to 3 mA.

3. Use the Test Record to record the 3 mA full-scale current reading.

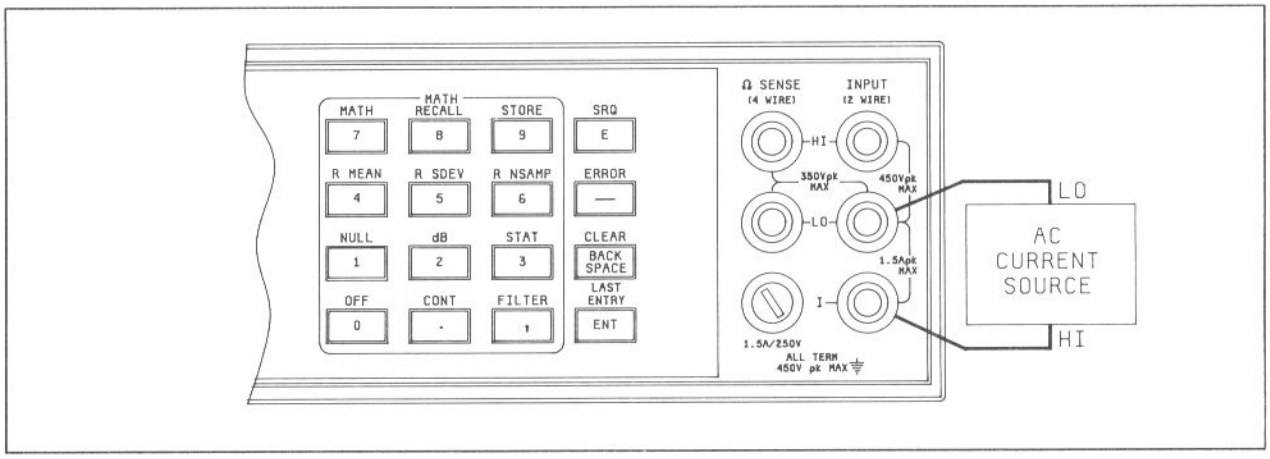
4. Set the HP 3457A to the 1 A range and set the DC Current Source for an output of 300 mA.

5. Use the Test Record to record the 300 mA reading.

6. If either of the readings are beyond the limits specified in Table 4-24 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

7. Set the output of the DC Current Source to 0 and disconnect it from the HP 3457A input terminals.

AC Current Operational Verification Tests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MATH RECALL
STORE
SRQ
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9
E
R MEAN
R SDEV
R NSAMP
ERROR
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6
—
NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
LAST ENTRY
OFF
CONT
FILTER
0
.
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX
LO
AC CURRENT SOURCE
HI

Figure 4-15. ACI Operational Verification Test Connections

4-78. AC Current Function - Gain Test

4-79. Equipment Required, An AC Current Source capable of providing a current of 300 mA (± .1%) at a frequency of 1 KHz is required for the following test.

1. Set the AC Current source for an output of 0 mA and connect it to the HP 3457A front panel **I** and **LO** input terminals.

2. Set the HP 3457A to the 300 mA range and the number of digits displayed (DIGITS DISP) to six. Set the AC Current Source for an output of 300 mA at a frequency of 1 KHz.

3. Use the Test Record to record the 300 mA full-scale reading.

4. If the full-scale reading is beyond the limits specified on the Test Record (301.0300 mA - 298.9700 mA), the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

5. Reduce the output of the AC Current Source to 0 and disconnect it from the HP 3457A input terminals.

2-Wire Ohms Operational Verification Tests

4-80. 2-Wire Ohms Function - Offset Test

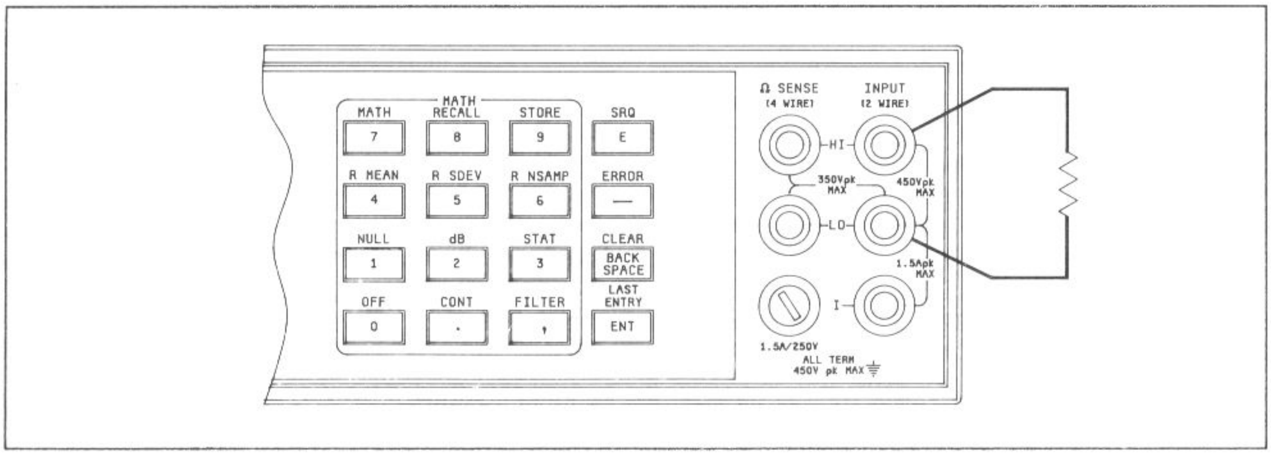
4-81. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Connect a low thermal short across the HP 3457A front panel HI and LO input terminals.

2. Set the HP 3457A to the 2-Wire Ohms Function, 3 Kohm range and the number of digits displayed (DIGITS DISP) to six.

3. Use the Test Record to record the offset readings for the 3 Kohm, 30 Kohm and 300 Kohm ranges.

2-Wire Ohms Operational Verification Tests Cont'd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MATH RECALL
STORE
SRQ
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R MEAN
R SDEV
R NSAMP
ERROR
4
5
6
—
NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
OFF
CONT
FILTER
LAST ENTRY
0
.
,
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
LO
I
350Vpk MAX
450Vpk MAX
1.5Apk MAX
1.5A/250V
ALL TERM 450V pk MAX

Figure 4-16. 2-Wire Ohms Operational Verification Test Connections

4. If any of the offset readings are beyond the limits specified in Table 4-25 and on the Test Record, the instrument should be calibrated. Refer to Section V of this manual for calibration procedures.

5 . Remove the short from the front panel input terminals.

3457A Input	3457A Range	3457A Set Up	90 day limits	1 year limits
Short	3 Kohm	OHM	0.000207 Kohm	0.000207 Kohm
Short	30 Kohm	OHM	00.00027 Kohm	00.00027 Kohm
Short	300 Kohm	OHM	000.0010 Kohm	000.0010 Kohm

Table 4-25. 2-Wire Ohms Offset Test Limits

4-82. 2-Wire Ohms Function - Gain Test

4-83. Equipment Required. Resistance Standards of 3 Kohms (± .001%), 30 Kohms (± .001%), and 300 Kohms (± .001%) are required for this procedure.

1.Set the HP 3457A to the 2-wire ohms function (OHM) and the number of digits displayed (DIGITS DISP) to six.

2. Connect the Resistance Standard to the HP 3457A front panel HI and LO input terminals. (The connecting wires should be as short as possible to reduce lead resistance).

3. Use the Test Record to record the 3 Kohm, 30 Kohm and 300 Kohm full-scale readings.

4. If any of the readings are beyond the limits specified in Table 4-26 and on the Test Record, the instrument should be calibrated. Refer to Section V of this manual for calibration procedures.

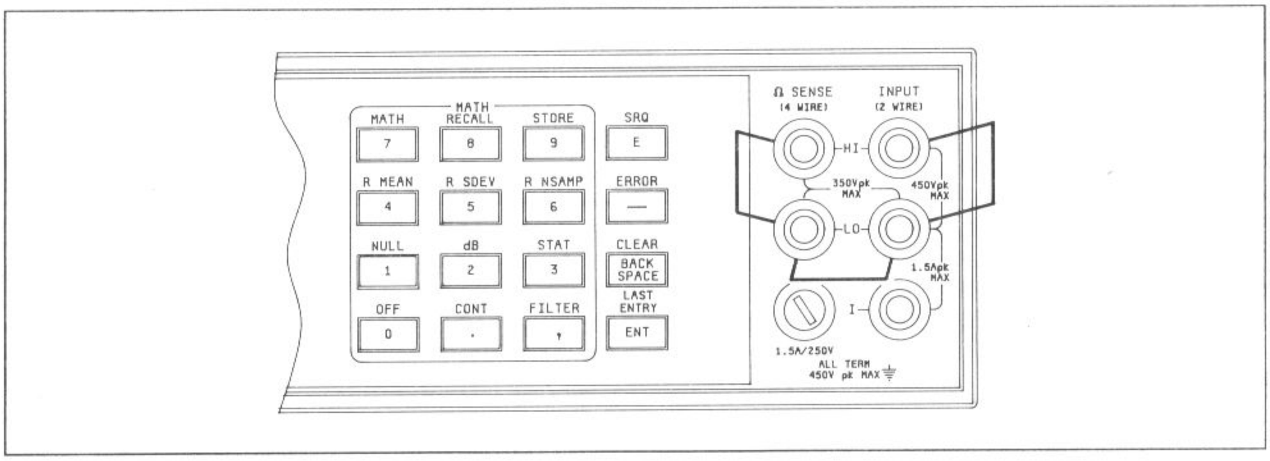
5. Remove the Resistance standard from the HP 3457A front panel input terminals.

2-Wire Ohms Operational Verification Tests Cont'd

3457A Input	3457A Range	3457A Set Up	90 day limits High	90 day limits Low	1 year limits High	1 year limits Low
3 Kohm	3 Kohm	OHM	3.000312 Kohm	2.999688 Kohm	3.000357 Kohm	2.999643 Kohm
30 Kohm	30 Kohm	OHM	30.00132 Kohm	29.99868 Kohm	30.00177 Kohm	29.99823 Kohm
300 Kohm	300 Kohm	OHM	300.0130 Kohm	299.9870 Kohm	300.0160 Kohm	299.9840 Kohm

Table 4-26. 2-Wire Ohms Gain Test Limits

4-Wire Ohms Operational Verification Tests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STORE
SRQ
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R MEAN
R SDEV
R NSAMP
ERROR
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5
6
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NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
LAST ENTRY
OFF
CONT
FILTER
0
.
,
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
LO
I
350Vpk MAX
450Vpk MAX
1.5Apk MAX
1.5A/250V
ALL TERM 450V pk MAX

Figure 4-17. 4-Wire Ohms Operational Verification Test Connections

4-84. 4-Wire Ohms Function - Offset Test

4-85. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Set the HP 3457A to the 4-Wire Ohms Function (OHMF) and the number of digits displayed (DIGITS DISP) to six.

2. Short the front panel input terminals of the HP 3457A as shown in Figure 4-17.

3. Use the Test Record to record the offset readings of the 3 Kohm, 30 Kohm and 300 Kohm ranges.

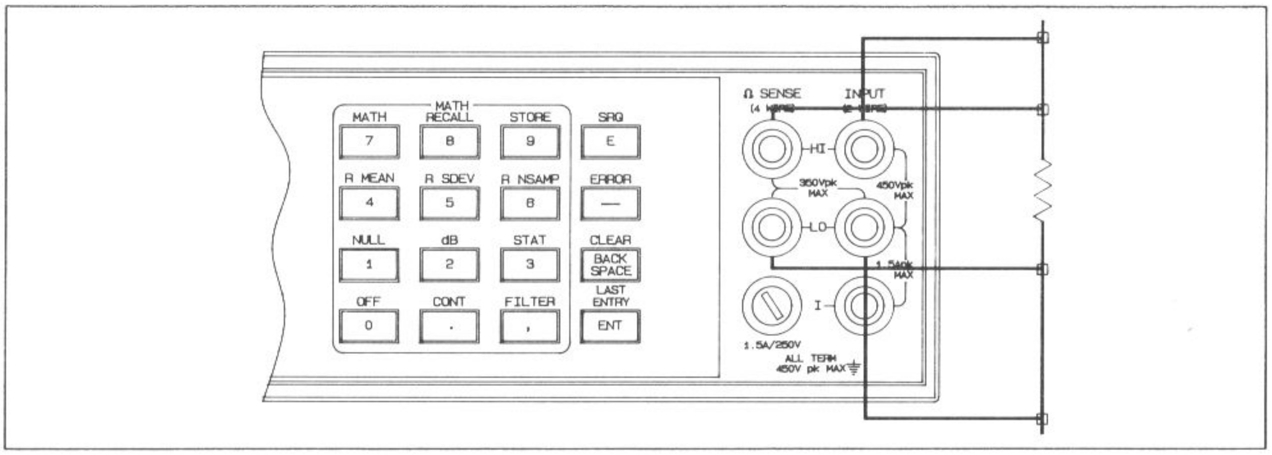
4. If any of the offset readings are beyond the limits specified in Table 4-27 and on the Test Record, the instrument should be calibrated. Refer to Section V of this manual for calibration procedures.

5. Remove the short from the front panel input terminals.

4-Wire Ohms Operational Verification Tests Cont'd

3457A Input	3457A Range	3457A Set Up	90 day limits	1 year limits
Short	3 Kohm	OHMF	0.000007 Kohm	0.000007 Kohm
Short	30 Kohm	OHMF	00.00007 Kohm	00.00007 Kohm
Short	300 Kohm	OHMF	000.0008 Kohm	000.0008 Kohm

Table 4-27. 4-Wire Ohms Offset Test Limits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R MEAN
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R SDEV
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R NSAMP
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ERROR
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NULL
1
dB
2
STAT
3
CLEAR
BACK SPACE
OFF
0
CONT
.
FILTER
,
LAST ENTRY
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX

Figure 4-18. 4-Wire Ohms Operational Verification Test Connections

4-86. 4-Wire Ohms Function - Gain Test

4-87. Equipment Required. Resistance Standards of 3 Kohms (± .001%), 30 Kohms (± .001%) and 300 Kohms (± .001%) are required for this procedure.

1. Set the HP 3457A to the 4-Wire ohms function (OHMF) and the number of digits displayed (DIGITS DISP) to six.

2. Connect the appropriate Resistance Standard to the HP 3457A front panel input terminals as shown in Figure 4-18.

3. Use the Test Record to record the resistance readings for the 3 Kohm, 30 Kohm and 300 Kohm ranges.

4. If any of the readings are beyond the limits specified in Table 4-28 and on the Test Record, the instrument should be calibrated. Refer to Section V of this manual for calibration procedures.

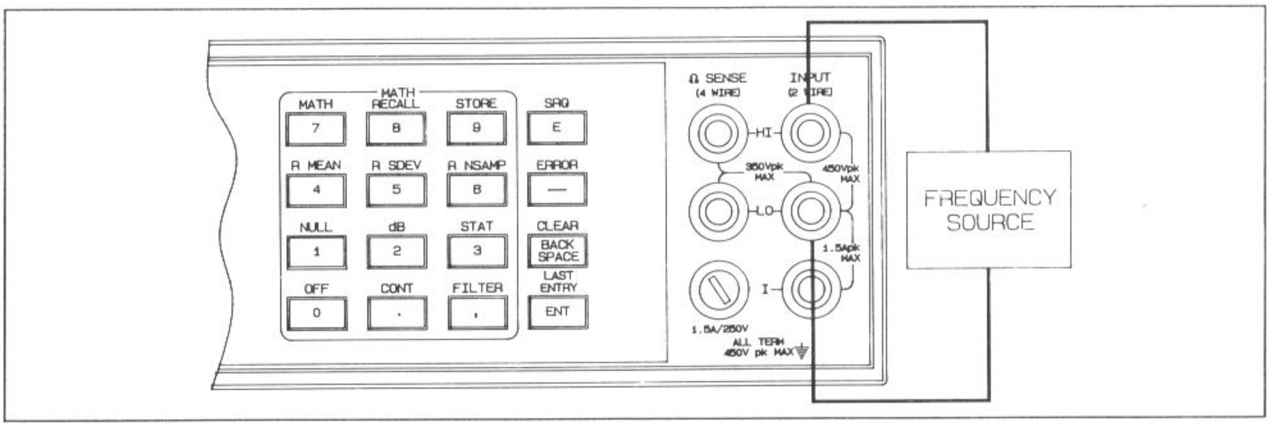
5. Remove the Resistance Standard from the HP 3457A front panel input terminals.

4-Wire Ohms Operational Verification Tests Cont'd

3457A Input	3457A Range	3457A Set Up	90 day limits High	90 day limits Low	1 year limits High	1 year limits Low
3 Kohm	3 Kohm	OHMF	3.000112 Kohm	2.999888 Kohm	3.000157 Kohm	2.999843 Kohm
30 Kohm	30 Kohm	OHMF	30.00112 Kohm	29.99888 Kohm	30.00157 Kohm	29.99844 Kohm
300 Kohm	300 Kohm	OHMF	300.0128 Kohm	299.9872 Kohm	300.0158 Kohm	299.9842 Kohm

Table 4-28. 4-Wire Ohms Gain Test Limits

Frequency Counter Operational Verification Tests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R MEAN
R SDEV
R NSAMP
ERROR
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NULL
dB
STAT
CLEAR
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3
BACK SPACE
OFF
CONT
FILTER
LAST ENTRY
0
.
,
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX
FREQUENCY SOURCE

Figure 4-19. Frequency Counter Operational Verification Test Connections

4-88. Frequency Counter - Accuracy Test

4-89. Equipment Required. A Frequency Source capable of providing a 20 Hz (± .01%) and a 1 MHz (± .003%) sine-wave signal is required for this procedure.

1. Set the HP 3457A to the Frequency Function (FREQ).

2. Set the Frequency Standard for a 1 volt, 20 Hz sine-wave output signal and connect it to the HI and LO input terminals of the HP 3457A.

3. Use the Test Record to record the frequency readings at 20 Hz and 1 MHz.

4. If either of the readings are beyond the limits specified, the instrument should be calibrated. Refer to Section V of this manual for calibration procedures.

Rear Input Operational Verification Tests (Standard Instrument)

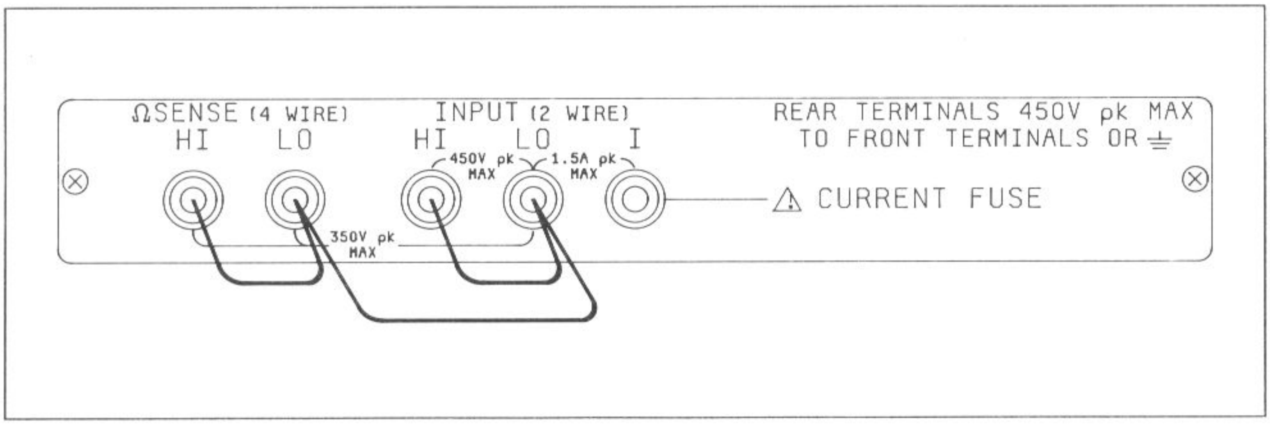

Figure 4-20. Standard Instrument Rear Input Test Connections

4-90. Preliminary Steps

1. Short the Rear Input HI and LO terminals and the Ω Sense HI and LO terminals as shown in Figure 4-9.

2. Select the Rear Terminal Input. (Press the TERM configuration key, enter the number 2 and press the ENT key.

4-91. DC Voltage Function - Rear Terminal Offset Test

4-92. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Set the HP 3457A to the DC Voltage function (DCV) and the number of digits displayed (DIGITS DISP) to six.

2. Test the HP 3457A input offset on the 30 V, 3 V and 300 mV ranges and record the reading of each range on the Test Record provided at the end of this section. Begin with the 30 V range to allow any thermal voltages which might affect the readings on the lower ranges to dissipate.

3. If any of the offset readings are beyond the limits specified in Table 4-29 and on the Test Record, the instrument should be calibrated. Refer to Section V of this manual for calibration procedures.

3457A Input	3457A Range	3457A Set Up	90 day limits High	90 day limits Low	1 year limits High	1 year limits Low
Short	30 V	DCV	+ 00.00020 V	- 00.00020 V	+ 00.00020 V	- 00.00020 V
Short	3 V	DCV	+ 0.000007 V	- 0.000007 V	+ 0.000007 V	- 0.000007 V
Short	300 mV	DCV	+000.0040 mV	-000.0040 mV	+000.0040 mV	-000.0040 mV

Table 4-29. DC Voltage Offset Test Limits (Rear Terminals)

Rear Input Operational Verification Tests (Standard Instrument) Cont'd

4-93. DC Current Function - Rear Terminal Offset Test

4-94. Equipment Required. This procedure does not require any test equipment.

1. Set the HP 3457A to the DC Current function (DCI), 3 mA range, and the number of digits displayed (DIGITS DISP) to six.

2. Use the Test Record to record the current offset readings on the 3 mA and 1 A ranges.

3. If any of the offset readings are beyond the limits specified in Table 4-30 and on the Test Record, the instrument should be calibrated. Refer to Section V of this manual for calibration procedures.

3457A Input	3457A Range	3457A Set Up	90 day limits		1 year limits	
			High	Low	High	Low
Open	3 mA	DCI	+0.000104 mA	-0.000104 mA	+0.000104 mA	-0.000104 mA
Open	30 mA	DCI	+00.00104 mA	-00.00104 mA	+00.00104 mA	-00.00104 mA

Table 4-30. DC Current Offset Test Limits (Rear Terminals)

4-95. 2-Wire Ohms Function - Rear Terminal Offset Test

4-96. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Set the HP 3457A to the 2-Wire Ohms Function, 3 Kohm range and the number of digits displayed (DIGITS DISP) to six.

2. Use the Test Record to record the offset readings for the 3 Kohm, 30 Kohm and 300 Kohm ranges.

3. If any of the offset readings are beyond the limits specified in Table 4-31 and on the Test Record, the instrument should be calibrated. Refer to Section V of this manual for calibration procedures.

3457A Input	3457A Range	3457A Set Up	90 day limits	1 year limits
Short	3 Kohm	OHM	0.000207 Kohm	0.000207 Kohm
Short	30 Kohm	OHM	00.00027 Kohm	00.00027 Kohm
Short	300 Kohm	OHM	000.0010 Kohm	000.0010 Kohm

Table 4-31. 2-Wire Ohms Offset Test Limits (Rear Terminals)

4-97. 4-Wire Ohms Function - Offset Test

4-98. Equipment Required. A low thermal short (copper wire) is required for this procedure.

1. Set the HP 3457A to the 4-Wire Ohms Function (OHMF) and the number of digits displayed (DIGITS DISP) to six.

Rear Input Operational Verification Tests (Standard Instrument) Cont'd

2. Use the Test Record to record the offset readings of the 3 Kohm, 30 Kohm and 300 Kohm ranges.

3. If any of the offset readings are beyond the limits specified in Table 4-32 and on the Test Record, the instrument should be calibrated. Refer to Section V of this manual for calibration procedures.

3457A Input	3457A Range	3457A Set Up	90 day limits	1 year limits
Short	3 Kohm	OHMF	0.000007 Kohm	0.000007 Kohm
Short	30 Kohm	OHMF	00.00007 Kohm	00.00007 Kohm
Short	300 Kohm	OHMF	000.0008 Kohm	000.0008 Kohm

Table 4-32. 4-Wire Ohms Offset Test Limits (Rear Terminals)

Rear Input Operational Verification Tests

(44491A General Purpose Relay Assy)

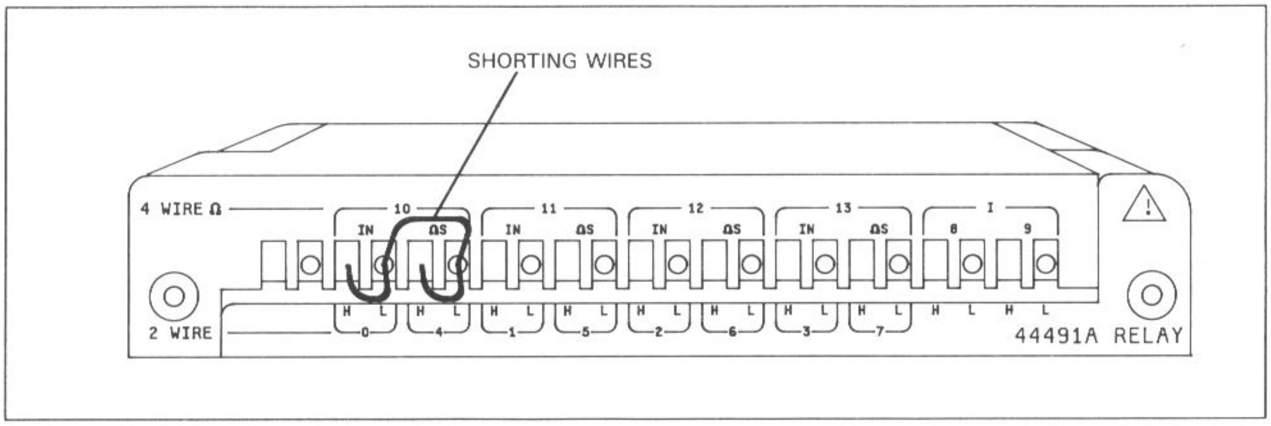

Figure 4-21. HP 44491A Terminal Block Assembly Connections

4-99. Preliminary Steps

1. Connect shorting wires to the channel 10 inputs of the Terminal Block assembly as shown in Figure 4-21.

2. Select the Scanner Input. (Press the TERM configuration key, enter the number 2 and press the ENT key).

NOTE

The 44491A Relay Assembly and the 3457A Multimeter must have been calibrated as a unit for these tests to apply. Calibration procedures are provided in Section V of this manual.

Rear Input Operational Verification Tests
(44491A General Purpose Relay Assy)

4-100. DC Voltage Function - 44491A Offset Test

4-101. Equipment Required. Low thermal (copper) shorting wires are required for this procedure.

1. Set the HP 3457A to the DC Voltage function (DCV) and the number of digits displayed (DIGITS DISP) to six.

2. Close channel 0. (Press the CHAN configuration key, enter the number 0 and press the ENT key).

3. Test the HP 3457A input offset on the 30 V, 3 V and 300 mV ranges and record the reading of each range on the Test Record provided at the end of this section. Begin with the 30 V range to allow any thermal voltages which might affect the readings on the lower ranges to dissipate.

4. If any of the offset readings are beyond the limits specified in Table 4-33 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

3457A Input	3457A Range	3457A Set Up	Test Limits High	Test Limits Low
Short	30 V	DCV	+ 00.00020 V	- 00.00020 V
Short	3 V	DCV	+ 0.000010 V	- 0.000010 V
Short	300 mV	DCV	+000.0070 mV	-000.0070 mV

Table 4-33. DC Voltage Offset Test Limits (44491A)

4-102. 2-Wire Ohms Function - 44491A Offset Test Limits

4-103. Equipment Required. Low thermal (copper) shorting wires are required for this procedure.

1. Set the HP 3457A to the 2-Wire Ohms Function, 3 Kohm range. Set the offset compensation (OFFSET COMP) on, and the number of digits displayed (DIGITS DISP) to six.

2. Close channel 0. (Press the CHAN configuration key, enter the number 0 and press the ENT key).

3. Use the Test Record to record the offset reading for the 3 Kohm range.

4. Test the ohms offset on channels 0 through 7 with the instrument set to the 3 Kohm range. Record the reading of each channel on the Test Record provided at the end of this section.

5. If any of the offset readings are beyond ± 0.002207 KOhms, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

4-104. 4-Wire Ohms Function - 44491A Offset Test Limits

4-105. Equipment Required. Low thermal (copper) shorting wires are required for this procedure.

1. Set the HP 3457A to the 4-Wire Ohms Function (OHMF). Set the offset compensation (OFFSET COMP) on, and the number of digits displayed (DIGITS DISP) to six.

Rear Input Operational Verification Tests (44491A General Purpose Relay Assy)

2. Close channel 10. (Press the CHAN configuration key, enter the number 10 and press the ENT key).

3. Use the Test Record to record the offset reading of the 3 Kohm range.

4. If any of the offset reading is beyond ± 0.000010 KOhm, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

4-106. DC Current Function - 44491A Offset Test Limits

4-107. Equipment Required. This procedure does not require any test equipment.

1. Set the HP 3457A to the DC Current function (DCI), 3 mA range, and the number of digits displayed (DIGITS DISP) to six.

2. Use the Test Record to record the current offset readings on the 3 mA and 1 A ranges.

3. If either of the offset readings are beyond the limits specified in Table 4-34 and on the Test Record, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

3457A Input	3457A Range	3457A Set Up	Test Limits High	Test Limits Low
Open	3 mA	DCI	+0.000104 mA	-0.000104 mA
Open	30 mA	DCI	+00.00104 mA	-00.00104 mA

Table 4-34. DC Current Offset Test Limits (44491A)

Rear Input Operational Verification Tests (44492A 10 Channel Multiplex Assy)

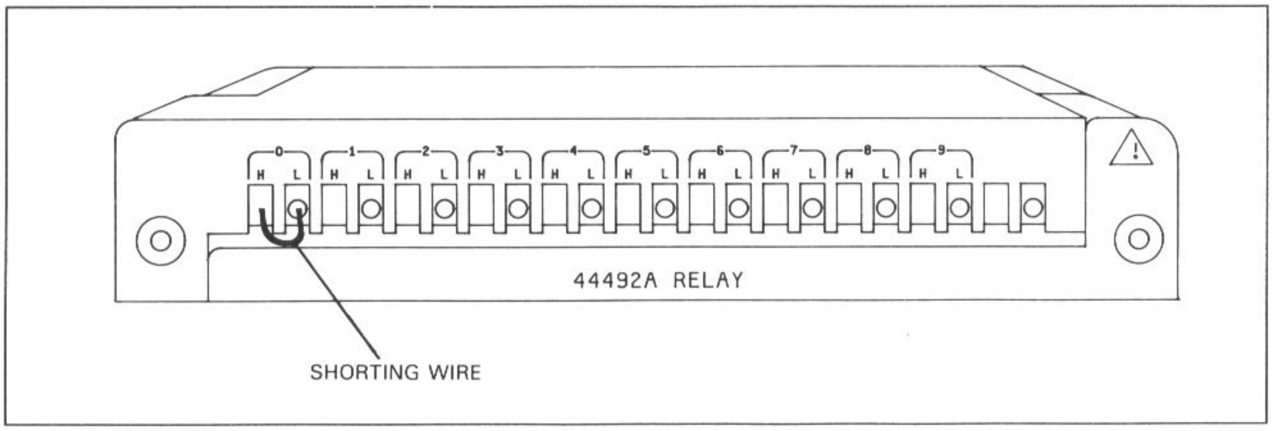

Figure 4-22. HP 44492A Terminal Block Assembly Connections

Rear Input Operational Verification Tests (44492A 10 Channel Multiplex Assy)

4-108. Preliminary Steps

1. Connect a shorting wire to the channel 0 inputs of the Terminal Block assembly as shown in Figure 4-22.

2. Select the Scanner Input. (Press the TERM configuration key, enter the number 2 and press the ENT key).

NOTE

The 44492A Multiplexer Assembly and the 3457A Multimeter must have been calibrated as a unit for these tests to apply. Calibration procedures are provided in Section V of this manual.

4-109. DC Voltage Function - 44492A Offset Test

4-110. Equipment Required. A low thermal (copper) shorting wire is required for this procedure.

1. Set the HP 3457A to the DC Voltage function (DCV) and the number of digits displayed (DIGITS DISP) to six.

2. Close channel 0. (Press the CHAN configuration key, enter the number 0 and press the ENT key).

3. Test the HP 3457A input offset on the 300 mV range and record the reading on the Test Record provided at the end of this section.

4. If the offset reading is beyond ± 000.0070 mV, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

4-111. 2-Wire Ohms Function - 44492A Offset Test Limits

4-112. Equipment Required. A low thermal (copper) shorting wire is required for this procedure.

1. Set the HP 3457A to the 2-Wire Ohms Function, 3 Kohm range. Set the offset compensation (OFFSET COMP) on, and the number of digits displayed (DIGITS DISP) to six.

2. Close channel 0. (Press the CHAN configuration key, enter the number 0 and press the ENT key).

3. Use the Test Record to record the offset reading for the 3 Kohm range.

4. Test the ohms offset on channels 0 through 9 with the instrument set to the 3 Kohm range. Record the reading of each channel on the Test Record provided at the end of this section.

5. If any of the offset readings are beyond ± 0.004210 KOhm, the instrument should be calibrated or repaired. Refer to Section V for calibration procedures.

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number________________

Test Performed by ____________
Date ___________
Reference Temperature_________

DC VOLTAGE TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	OFFSET TEST						
1	Short	300 V Range	+ 000.0007 V		- 000.0007 V		
2	Short	30 V Range	+ 00.00020 V		- 00.00020 V		
3	Short	3 V Range	+ 0.000007 V		- 0.000007 V		
4	Short	300 mV Range	+ 000.0040 mV		- 000.0040 mV		
5	Short	30 mV Range	+ 00.00385 mV		- 00.00385 mV		
	GAIN TEST						
6	30 mV	30 mV Range	+ 30.00505 mV		+ 29.99495 mV		
7	300 mV	300 mV Range	+ 300.0115 mV		+ 299.9885 mV		
8	3 V	3 V Range	+ 3.000058 V		+ 2.999942 V		
9	30 V	30 V Range	+ 30.00125 V		+ 29.99875 V		
10	300 V	300 V Range	+ 300.0157 V		+ 299.9843 V		
	LINEARITY TEST						
11	3 V	3 V Range	+ 3.000058 V		+ 2.999942 V		
12	2 V	3 V Range	+ 2.000041 V		+ 1.999959 V		
13	1 V	3 V Range	+ 1.000024 V		+ 0.999976 V		
14	- 1 V	3 V Range	- 0.999976 V		- 1.000024 V		
15	- 2 V	3 V Range	- 1.999959 V		- 2.000041 V		
16	- 3 V	3 V Range	- 2.999942 V		- 3.000058 V		

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number________________

Test Performed by ____________
Date ___________
Reference Temperature_________

AC VOLTAGE TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
1	Set the 3457A to the AC Voltage Function and run the AUTO-CAL 2 routine.						
	GAIN TEST						
2	30mV,1KHz	30 mVAC Range	30.05020 mV		29.94980 mV		
3	300mV,1KHz	300 mVAC Range	300.5020 mV		299.4980 mV		
4	1V,1KHz	3 VAC Range	1.002420 V		0.997580 V		
5	2V,1KHz	3 VAC Range	2.003720 V		1.996280 V		
6	3V,1KHz	3 VAC Range	3.005100 V		2.994900 V		
7	30V,1KHz	30 VAC Range	30.05020 V		29.94980 V		
8	300V,1KHz	300 VAC Range	300.6820 V		299.3180 V		
9	30V,1KHz	300 VAC Range	030.1690 V		029.8310 V		
10	3V,1KHz	30 VAC Range	03.01510 V		02.98490 V		
11	300mV,1KHz	3 VAC Range	0.301510 V		0.298490 V		
12	30mV,1KHz	300 mVAC Range	030.1510 mV		029.8490 mV		
13	Set the 3457A to AC Fast Response (ACBAND > 400)						
	FREQUENCY RESPONSE TEST						
14	30mV,1MHz	300 mVAC Range	039.6880 mV		020.3120 mV		
15	30mV,300KHz	300 mVAC Range	031.9180 mV		028.0820 mV		
16	30mV,100KHz	300 mVAC Range	030.4080 mV		029.5920 mV		
17	30mV,20KHz	300 mVAC Range	030.1510 mV		029.8490 mV		
18	30mV,6.5KHz	300 mVAC Range	030.1510 mV		029.8490 mV		
19	30mV,400Hz	300 mVAC Range	030.1510 mV		029.8490 mV		

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
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AC VOLTAGE TEST (Cont'd)

FREQUENCY RESPONSE TEST (Cont'd)

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
20	300mV,1MHz	300 mVAC Range	337.1200 mV		262.8800 mV		
21	300mV,300KHz	300 mVAC Range	310.4500 mV		289.5500 mV		
22	300mV,100KHz	300 mVAC Range	302.1900 mV		297.8100 mV		
23	300mV,20KHz	300 mVAC Range	300.5320 mV		299.4680 mV		
24	300mV,6.5KHz	300 mVAC Range	300.5320 mV		299.4680 mV		
25	300mV,400Hz	300 mVAC Range	300.5320 mV		299.4680 mV		
26	300mV,1MHz	3 VAC Range	0.396880 V		0.203120 V		
27	300mV,300KHz	3 VAC Range	0.319180 V		0.280820 V		
28	300mV,100KHz	3 VAC Range	0.304080 V		0.295920 V		
29	300mV,20KHz	3 VAC Range	0.301510 V		0.298490 V		
30	300mV,6.5KHz	3 VAC Range	0.301510 V		0.298490 V		
31	300mV,400Hz	3 VAC Range	0.301510 V		0.298490 V		
32	3V,1MHz	3 VAC Range	3.371200 V		2.628800 V		
33	3V,300KHz	3 VAC Range	3.104500 V		2.895500 V		
34	3V,100KHz	3 VAC Range	3.021900 V		2.978100 V		
35	3V,20KHz	3 VAC Range	3.005320 V		2.994680 V		
36	3V,6.5KHz	3 VAC Range	3.005320 V		2.994680 V		
37	3V,400Hz	3 VAC Range	3.005320 V		2.994680 V		

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
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Test Performed by ____________
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AC VOLTAGE TEST (Cont'd)

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	FREQUENCY RESPONSE TEST (Cont'd)						
37	Set the 3457A to AC Slow Response (ACBAND < 400)						
38	3V,100Hz	3 VAC Range	3.008800 V	_______________	2.991200 V	______	______
39	3V,45Hz	3 VAC Range	3.026800 V	_______________	2.973200 V	______	______
40	3V,20Hz	3 VAC Range	3.026800 V	_______________	2.973200 V	______	______
41	300mV,100Hz	300 mVAC Range	300.8800 mV	_______________	299.1200 mV	______	______
42	300mV,45Hz	300 mVAC Range	302.6800 mV	_______________	297.3200 mV	______	______
43	300mV,20Hz	300 mVAC Range	302.6800 mV	_______________	297.3200 mV	______	______

FREQUENCY TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
1	1V,20Hz	3 VAC Range	20.01000 Hz	_______________	19.99000 Hz	______	______
2	1V,1MHz	3 VAC Range	1.000100 MHz	_______________	0.999900 MHz	______	______

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number_______________

Test Performed by ____________
Date __________
Reference Temperature_________

DC CURRENT TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	OFFSET TEST						
1	Open	300 uADCI Range	+ 000.0104 uA	______________	- 000.0104 uA	______	______
2	Open	3 mADCI Range	+ 0.000104 mA	______________	- 0.000104 mA	______	______
3	Open	30 mADCI Range	+ 00.00104 mA	______________	- 00.00104 mA	______	______
4	Open	300 mADCI Range	+ 000.0204 mA	______________	- 000.0204 mA	______	______
5	Open	1 ADCI Range	+ 0.000604 A	______________	- 0.000604 A	______	______
	GAIN TEST						
6	300 uA	300 uADCI Range	300.0704 uA	______________	299.9296 uA	______	______
7	3 mA	3 mADCI Range	3.000704 mA	______________	2.999296 mA	______	______
8	30 mA	30 mADCI Range	30.00704 ma	______________	29.99296 mA	______	______
9	300 mA	300 mADCI Range	300.2304 mA	______________	299.7696 mA	______	______
10	1 A	1 ADCI Range	1.001304 A	______________	0.998696 A	______	______

AC CURRENT TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	GAIN TEST						
1	30 mA	30 mAACI Range	30.10300 mA	______________	29.89700 mA	______	______
2	300 mA	300 mAACI Range	301.0300 mA	______________	298.9700 mA	______	______
3	1 A	1 AACI Range	1.005300 A	______________	0.994700 A	______	______

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
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2-WIRE OHMS TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	OFFSET TEST						
1	Short	30 Ohm Range	+ 00.20335 ohm		- 00.20335 ohm		
2	Short	300 Ohm Range	+ 000.2035 ohm		- 000.2035 ohm		
3	Short	3 KOhm Range	+ 0.000207 Kohm		- 0.000207 Kohm		
4	Short	30 KOhm Range	+ 00.00027 Kohm		- 00.00027 Kohm		
5	Short	300 KOhm Range	+ 000.0010 Kohm		- 000.0010 Kohm		
6	Short	3 MOhm Range	+ 0.000014 Mohm		- 0.000014 Mohm		
7	Short	30 MOhm Range	+ 00.00083 Mohm		- 00.00083 Mohm		
	GAIN TEST						
8	30 Ohm	30 Ohm Range	30.20530 ohm		29.79470 ohm		
9	300 Ohm	300 Ohm Range	300.2170 ohm		299.7830 ohm		
10	3 KOhm	3 KOhm Range	3.000312 Kohm		2.999688 Kohm		
11	30 KOhm	30 KOhm Range	30.00132 Kohm		29.99868 Kohm		
12	300 KOhm	300 KOhm Range	300.0130 Kohm		299.9870 Kohm		
13	3 MOhm	3 MOhm Range	3.000179 Mohm		2.999821 Mohm		
14	30 MOhm	30 MOhm Range	30.00833 Mohm		29.99167 Mohm		

PERFORMANCE TEST CARD
90 DAY LIMITS

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4-WIRE OHMS TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	OFFSET TEST						
1	Short	30 Ohm Range	+ 00.00335 ohm		- 00.00335 ohm		
2	Short	300 Ohm Range	+ 000.0035 ohm		- 000.0035 ohm		
3	Short	3 KOhm Range	+ 0.000007 Kohm		- 0.000007 Kohm		
4	Short	30 KOhm Range	+ 00.00007 Kohm		- 00.00007 Kohm		
5	Short	300 KOhm Range	+ 000.0008 Kohm		- 000.0008 Kohm		
6	Short	3 MOhm Range	+ 0.000014 Mohm		- 0.000014 Mohm		
7	Short	30 MOhm Range	+ 00.00083 Mohm		- 00.00083 Mohm		
	GAIN TEST						
8	30 Ohm	30 Ohm Range	30.00530 ohm		29.99470 ohm		
9	300 Ohm	300 Ohm Range	300.0170 ohm		299.9830 ohm		
10	3 KOhm	3 KOhm Range	3.000112 Kohm		2.999888 Kohm		
11	30 KOhm	30 KOhm Range	30.00112 Kohm		29.99888 Kohm		
12	300 KOhm	300 KOhm Range	300.0128 Kohm		299.9872 Kohm		
13	3 MOhm	3 MOhm Range	3.000179 Mohm		2.999821 Mohm		
14	30 MOhm	30 MOhm Range	30.00833 Mohm		29.99167 Mohm		

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature_________

REAR INPUT TESTS (STANDARD INSTRUMENT)

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	DC VOLTAGE OFFSET TEST (Rear Terminals)						
1	Short	300 V Range	+ 000.0007 V		- 000.0007 V		
2	Short	30 V Range	+ 00.00020 V		- 00.00020 V		
3	Short	3 V Range	+ 0.000007 V		- 0.000007 V		
4	Short	300 mV Range	+ 000.0040 mV		- 000.0040 mV		
5	Short	30 mV Range	+ 00.00385 mV		- 00.00385 mV		
	DC CURRENT OFFSET TEST (Rear Terminals)						
6	Open	300 uADCI Range	+ 000.0104 uA		- 000.0104 uA		
7	Open	3 mADCI Range	+ 0.000104 mA		- 0.000104 mA		
8	Open	30 mADCI Range	+ 00.00104 mA		- 00.00104 mA		
9	Open	300 mADCI Range	+ 000.0204 mA		- 000.0204 mA		
10	Open	3 ADCI Range	+ 0.000604 A		- 0.000604 A		
	2-WIRE OHMS OFFSET TEST (Rear Terminals)						
11	Short	30 Ohm Range	+ 00.20335 ohm		- 00.20335 ohm		
12	Short	300 Ohm Range	+ 000.2035 ohm		- 000.2035 ohm		
13	Short	3 KOhm Range	+ 0.000207 Kohm		- 0.000207 Kohm		
14	Short	30 KOhm Range	+ 00.00027 Kohm		- 00.00027 Kohm		
15	Short	300 KOhm Range	+ 000.0010 Kohm		- 000.0010 Kohm		
16	Short	3 MOhm Range	+ 0.000014 Mohm		- 0.000014 Mohm		
17	Short	30 MOhm Range	+ 00.00083 Mohm		- 00.00083 Mohm		

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature_________

REAR INPUT TESTS (STANDARD INSTRUMENT)

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	4-WIRE OHMS OFFSET TEST (Rear Terminals)						
18	Short	30 Ohm Range	+ 00.00335 ohm	______________	- 00.00335 ohm	_____	_____
19	Short	300 Ohm Range	+ 000.0035 ohm	______________	- 000.0035 ohm	_____	_____
20	Short	3 KOhm Range	+ 0.000007 Kohm	______________	- 0.000007 Kohm	_____	_____
21	Short	30 KOhm Range	+ 00.00007 Kohm	______________	- 00.00007 Kohm	_____	_____
22	Short	300 KOhm Range	+ 000.0008 Kohm	______________	- 000.0008 Kohm	_____	_____
23	Short	3 MOhm Range	+ 0.000014 Mohm	______________	- 0.000014 Mohm	_____	_____
24	Short	30 MOhm Range	+ 00.00083 Mohm	______________	- 00.00083 Mohm	_____	_____

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature________

REAR INPUT TESTS (44491A General Purpose Relay Assy)

Step#	3457 Input	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	DC VOLTAGE OFFSET TEST (44491A)						
1	Short	300 V Rng (Chan 0)	+ 000.0007 V		- 000.0007 V		
2	Short	30 V Rng (Chan 0)	+ 00.00020 V		- 00.00020 V		
3	Short	3 V Rng (Chan 0)	+ 0.000010 V		- 0.000010 V		
4	Short	300 mV Rng (Chan 0)	+ 000.0070 mV		- 000.0070 mV		
5	Short	30 mV Rng (Chan 0)	+ 00.00685 mV		- 00.00685 mV		
6	Short	30 mV Rng (Chan 1)	+ 00.00685 mV		- 00.00685 mV		
7	Short	30 mV Rng (Chan 2)	+ 00.00685 mV		- 00.00685 mV		
8	Short	30 mV Rng (Chan 3)	+ 00.00685 mV		- 00.00685 mV		
9	Short	30 mV Rng (Chan 4)	+ 00.00685 mV		- 00.00685 mV		
10	Short	30 mV Rng (Chan 5)	+ 00.00685 mV		- 00.00685 mV		
11	Short	30 mV Rng (Chan 6)	+ 00.00685 mV		- 00.00685 mV		
12	Short	30 mV Rng (Chan 7)	+ 00.00685 mV		- 00.00685 mV		
	2-WIRE OHMS OFFSET TEST (44491A)						
13	Short	30 MOhm Rng (Chan 0)	+ 00.00086 MOhm		- 00.00086 MOhm		
14	Short	3 MOhm Rng (Chan 0)	+ 0.000019 MOhm		- 0.000019 MOhm		
15	Short	300 KOhm Rng (Chan 0)	+ 000.0033 KOhm		- 000.0033 KOhm		
16	Short	30 KOhm Rng (Chan 0)	+ 00.00230 KOhm		- 00.00230 KOhm		
17	Short	3 KOhm Rng (Chan 0)	+ 0.002210 KOhm		- 0.002210 KOhm		
18	Short	300 Ohm Rng (Chan 0)	+ 002.2065 Ohm		- 002.2065 Ohm		
19	Short	30 Ohm Rng (Chan 0)	+ 02.20635 Ohm		- 02.20635 Ohm		

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date ___________
Reference Temperature________

REAR INPUT TESTS (44491A General Purpose Relay Assy)

Step#	3457 Input	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
20	Short	30 Ohm Rng (Chan 1)	+ 02.20635 Ohm	______________	- 02.20635 Ohm	______	______
21	Short	30 Ohm Rng (Chan 2)	+ 02.20635 Ohm	______________	- 02.20635 Ohm	______	______
22	Short	30 Ohm Rng (Chan 3)	+ 02.20635 Ohm	______________	- 02.20635 Ohm	______	______
23	Short	30 Ohm Rng (Chan 4)	+ 02.20635 Ohm	______________	- 02.20635 Ohm	______	______
24	Short	30 Ohm Rng (Chan 5)	+ 02.20635 Ohm	______________	- 02.20635 Ohm	______	______
25	Short	30 Ohm Rng (Chan 6)	+ 02.20635 Ohm	______________	- 02.20635 Ohm	______	______
26	Short	30 Ohm Rng (Chan 7)	+ 02.20635 Ohm	______________	- 02.20635 Ohm	______	______
	4-WIRE OHMS OFFSET TEST (44491A)						
27	Short	30 Ohm Rng (Chan 10)	+ 00.00635 Ohm	______________	- 00.00635 Ohm	______	______
28	Short	300 Ohm Rng (Chan 10)	+ 000.0065 Ohm	______________	- 000.0065 Ohm	______	______
29	Short	3 KOhm Rng (Chan 10)	+ 0.000010 KOhm	______________	- 0.000010 KOhm	______	______
30	Short	30 KOhm Rng (Chan 10)	+ 00.00010 KOhm	______________	- 00.00010 KOhm	______	______
31	Short	300 KOhm Rng (Chan 10)	+ 000.0011 KOhm	______________	- 000.0011 KOhm	______	______
32	Short	3 MOhm Rng (Chan 10)	+ 0.000017 MOhm	______________	- 0.000017 MOhm	______	______
33	Short	30 MOhm Rng (Chan 10)	+ 00.00086 MOhm	______________	- 00.00086 MOhm	______	______
	DC CURRENT OFFSET TEST (44491A)						
34	Open	300 uA Range	+ 000.0104 uA	______________	- 000.0104 uA	______	______
35	Open	3 mA Range	+ 0.000104 mA	______________	- 0.000104 mA	______	______
36	Open	30 mA Range	+ 00.00104 mA	______________	- 00.00104 mA	______	______
37	Open	300 mA Range	+ 000.0204 mA	______________	- 000.0204 mA	______	______
38	Open	3 A Range	+ 0.000604 A	______________	- 0.000604 A	______	______

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ___________
Date ___________
Reference Temperature_________

REAR INPUT TESTS (44492A 10 Channel Multiplex Assy)

Step#	3457 Input	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	DC VOLTAGE OFFSET TEST (44492A)						
1	Short	300 V Rng (Chan 0)	+ 000.0007 V	______________	- 000.0007 V	______	______
2	Short	30 V Rng (Chan 0)	+ 00.00020 V	______________	- 00.00020 V	______	______
3	Short	3 V Rng (Chan 0)	+ 0.000010 V	______________	- 0.000010 V	______	______
4	Short	300 mV Rng (Chan 0)	+ 000.0070 mV	______________	- 000.0070 mV	______	______
5	Short	300 mV Rng (Chan 1)	+ 000.0070 mV	______________	- 000.0070 mV	______	______
6	Short	300 mV Rng (Chan 2)	+ 000.0070 mV	______________	- 000.0070 mV	______	______
7	Short	300 mV Rng (Chan 3)	+ 000.0070 mV	______________	- 000.0070 mV	______	______
8	Short	300 mV Rng (Chan 4)	+ 000.0070 mV	______________	- 000.0070 mV	______	______
9	Short	300 mV Rng (Chan 5)	+ 000.0070 mV	______________	- 000.0070 mV	______	______
10	Short	300 mV Rng (Chan 6)	+ 000.0070 mV	______________	- 000.0070 mV	______	______
11	Short	300 mV Rng (Chan 7)	+ 000.0070 mV	______________	- 000.0070 mV	______	______
12	Short	300 mV Rng (Chan 8)	+ 000.0070 mV	______________	- 000.0070 mV	______	______
13	Short	300 mV Rng (Chan 9)	+ 000.0070 mV	______________	- 000.0070 mV	______	______
	2-WIRE OHMS OFFSET TEST (44492A)						
14	Short	30 MOhm Rng (Chan 0)	+ 00.00086 KOhm	______________	- 00.00086 KOhm	______	______
15	Short	3 MOhm Rng (Chan 0)	+ 0.000021 MOhm	______________	- 0.000021 MOhm	______	______
16	Short	300 KOhm Rng (Chan 0)	+ 000.0033 KOhm	______________	- 000.0033 KOhm	______	______
17	Short	30 KOhm Rng (Chan 0)	+ 00.00230 KOhm	______________	- 00.00230 KOhm	______	______
18	Short	3 KOhm Rng (Chan 0)	+ 0.002210 KOhm	______________	- 0.002210 KOhm	______	______
19	Short	300 Ohm Rng (Chan 0)	+ 004.2065 Ohm	______________	- 004.2065 Ohm	______	______
20	Short	300 Ohm Rng (Chan 1)	+ 004.2065 Ohm	______________	- 004.2065 Ohm	______	______

PERFORMANCE TEST CARD
90 DAY LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature_________

REAR INPUT TESTS (44492A 10 Channel Multiplex Assy)

Step#	3457 Input	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	2-WIRE OHMS OFFSET TEST (44492A) CONT'D						
21	Short	300 Ohm Rng (Chan 2)	+ 004.2065 Ohm	______________	- 004.2065 Ohm	______	______
22	Short	300 Ohm Rng (Chan 3)	+ 004.2065 Ohm	______________	- 004.2065 Ohm	______	______
23	Short	300 Ohm Rng (Chan 4)	+ 004.2065 Ohm	______________	- 004.2065 Ohm	______	______
24	Short	300 Ohm Rng (Chan 5)	+ 004.2065 Ohm	______________	- 004.2065 Ohm	______	______
25	Short	300 Ohm Rng (Chan 6)	+ 004.2065 Ohm	______________	- 004.2065 Ohm	______	______
26	Short	300 Ohm Rng (Chan 7)	+ 004.2065 Ohm	______________	- 004.2065 Ohm	______	______
27	Short	300 Ohm Rng (Chan 8)	+ 004.2065 Ohm	______________	- 004.2065 Ohm	______	______
28	Short	300 Ohm Rng (Chan 9)	+ 004.2065 Ohm	______________	- 004.2065 Ohm	______	______

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number_______________

Test Performed by _____________
Date ___________
Reference Temperature__________

DC VOLTAGE TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	OFFSET TEST						
1	Short	300 V Range	+ 000.0007 V		- 000.0007 V		
2	Short	30 V Range	+ 00.00020 V		- 00.00020 V		
3	Short	3 V Range	+ 0.000007 V		- 0.000007 V		
4	Short	300 mV Range	+ 000.0040 mV		- 000.0040 mV		
5	Short	30 mV Range	+ 00.00385 mV		- 00.00385 mV		
	GAIN TEST						
6	30 mV	30 mV Range	+ 30.00520 mV		+ 29.99480 mV		
7	300 mV	300 mV Range	+ 300.0145 mV		+ 299.9855 mV		
8	3 V	3 V Range	+ 3.000082 V		+ 2.999918 V		
9	30 V	30 V Range	+ 30.00140 V		+ 29.99860 V		
10	300 V	300 V Range	+ 300.0172 V		+ 299.9828 V		
	LINEARITY TEST						
11	3 V	3 V Range	+ 3.000082 V		+ 2.999918 V		
12	2 V	3 V Range	+ 2.000057 V		+ 1.999943 V		
13	1 V	3 V Range	+ 1.000032 V		+ 0.999968 V		
14	- 1 V	3 V Range	- 0.999968 V		- 1.000032 V		
15	- 2 V	3 V Range	- 1.999943 V		- 2.000057 V		
16	- 3 V	3 V Range	- 2.999918 V		- 3.000082 V		

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature_________

AC VOLTAGE TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
1	Set the 3457A to the AC Voltage Function and run the AUTO-CAL 2 routine.						
	GAIN TEST						
2	30mV,1KHz	30 mVAC Range	30.06420 mV	______________	29.93580 mV	______	______
3	300mV,1KHz	300 mVAC Range	300.6420 mV	______________	299.3580 mV	______	______
4	1V,1KHz	3 VAC Range	1.003020 V	______________	0.996980 V	______	______
5	2V,1KHz	3 VAC Range	2.004720 V	______________	1.995280 V	______	______
6	3V,1KHz	3 VAC Range	3.006420 V	______________	2.993580 V	______	______
7	30V,1KHz	30 VAC Range	30.06420 V	______________	29.93580 V	______	______
8	300V,1KHz	300 VAC Range	300.8220 V	______________	299.1780 V	______	______
9	30V,1KHz	300 VAC Range	30.2010 V	______________	29.7990 V	______	______
10	3V,1KHz	30 VAC Range	3.01830 V	______________	2.98170 V	______	______
11	300mV,1KHz	3 VAC Range	.301830 V	______________	.298170 V	______	______
12	30mV,1KHz	300 mVAC Range	30.1830 mV	______________	29.8170 mV	______	______
13	Set the 3457A to AC Fast Response (ACBAND > 400)						
	FREQUENCY RESPONSE TEST						
14	30mV,1MHz	300 mVAC Range	039.7200 mV	______________	020.2800 mV	______	______
15	30mV,300KHz	300 mVAC Range	031.9500 mV	______________	028.0500 mV	______	______
16	30mV,100KHz	300 mVAC Range	030.4400 mV	______________	029.5600 mV	______	______
17	30mV,20KHz	300 mVAC Range	030.1830 mV	______________	029.8170 mV	______	______
18	30mV,6.5KHz	300 mVAC Range	030.1830 mV	______________	029.8170 mV	______	______
19	30mV,400Hz	300 mVAC Range	030.1830 mV	______________	029.8170 mV	______	______

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number_______________

Test Performed by ____________
Date __________
Reference Temperature_________

AC VOLTAGE TEST (Cont'd)

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	FREQUENCY RESPONSE TEST (Cont'd)						
20	300mV,1MHz	300 mVAC Range	337.2600 mV		262.7400 mV		
21	300mV,300KHz	300 mVAC Range	310.5900 mV		289.4100 mV		
22	300mV,100KHz	300 mVAC Range	302.3300 mV		297.6700 mV		
23	300mV,20KHz	300 mVAC Range	300.6420 mV		299.3580 mV		
24	300mV,6.5KHz	300 mVAC Range	300.6420 mV		299.3580 mV		
25	300mV,400Hz	300 mVAC Range	300.6420 mV		299.3580 mV		
26	300mV,1MHz	3 VAC Range	0.397200 V		0.202800 V		
27	300mV,300KHz	3 VAC Range	0.319500 V		0.280500 V		
28	300mV,100KHz	3 VAC Range	0.304400 V		0.295600 V		
29	300mV,20KHz	3 VAC Range	0.301830 V		0.298170 V		
30	300mV,6.5KHz	3 VAC Range	0.301830 V		0.298170 V		
31	300mV,400Hz	3 VAC Range	0.301830 V		0.298170 V		
32	3V,1MHz	3 VAC Range	3.372600 V		2.627400 V		
33	3V,300KHz	3 VAC Range	3.105900 V		2.894100 V		
34	3V,100KHz	3 VAC Range	3.023300 V		2.976700 V		
35	3V,20KHz	3 VAC Range	3.006420 V		2.993580 V		
36	3V,6.5KHz	3 VAC Range	3.006420 V		2.993580 V		
37	3V,400Hz	3 VAC Range	3.006420 V		2.993580 V		

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature_________

AC VOLTAGE TEST (Cont'd)

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	FREQUENCY RESPONSE TEST (Cont'd)						
38	Set the 3457A to AC Slow Response (ACBAND < 400)						
39	3V,100Hz	3 VAC Range	3.008820 V	______________	2.991180 V	_____	_____
40	3V,45Hz	3 VAC Range	3.019320 V	______________	2.980680 V	_____	_____
41	3V,20Hz	3 VAC Range	3.019320 V	______________	2.980680 V	_____	_____
42	300mV,100Hz	300 mVAC Range	300.8820 mV	______________	299.1180 mV	_____	_____
43	300mV,45Hz	300 mVAC Range	301.9320 mV	______________	298.0680 mV	_____	_____
44	300mV,20Hz	300 mVAC Range	301.9320 mV	______________	298.0680 mV	_____	_____

FREQUENCY TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
1	1V,20Hz	3 VAC Range	20.01000 Hz	______________	19.99000 Hz	_____	_____
2	1V,1MHz	3 VAC Range	1.000100 MHz	______________	0.999900 MHz	_____	_____

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date ___________
Reference Temperature_________

DC CURRENT TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	OFFSET TEST						
1	Open	300 uADCI Range	+ 000.0104 uA		- 000.0104 uA		
2	Open	3 mADCI Range	+ 0.000104 mA		- 0.000104 mA		
3	Open	30 mADCI Range	+ 00.00104 mA		- 00.00104 mA		
4	Open	300 mADCI Range	+ 000.0204 mA		- 000.0204 mA		
5	Open	1 ADCI Range	+ 0.000604 A		- 0.000604 A		
	GAIN TEST						
6	300 uA	300 uADCI Range	300.1304 uA		299.8696 uA		
7	3 mA	3 mADCI Range	3.001304 mA		2.998696 mA		
8	30 mA	30 mADCI Range	30.01304 ma		29.98696 mA		
9	300 mA	300 mADCI Range	300.2604 mA		299.7396 mA		
10	1 A	1 ADCI Range	1.001304 A		0.998696 A		

AC CURRENT TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	GAIN TEST						
1	30 mA	30 mAACI Range	30.12700 mA		29.87300 mA		
2	300 mA	300 mAACI Range	301.2700 mA		298.7300 mA		
3	1 A	1 AACI Range	1.007100 A		0.992900 A		

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature_________

2-WIRE OHMS TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	OFFSET TEST						
1	Short	30 Ohm Range	+ 00.20335 ohm		- 00.20335 ohm		
2	Short	300 Ohm Range	+ 000.2035 ohm		- 000.2035 ohm		
3	Short	3 KOhm Range	+ 0.000207 Kohm		- 0.000207 Kohm		
4	Short	30 KOhm Range	+ 00.00027 Kohm		- 00.00027 Kohm		
5	Short	300 KOhm Range	+ 000.0010 Kohm		- 000.0010 Kohm		
6	Short	3 MOhm Range	+ 0.000014 Mohm		- 0.000014 Mohm		
7	Short	30 MOhm Range	+ 00.00083 Mohm		- 00.00083 Mohm		
	GAIN TEST						
8	30 Ohm	30 Ohm Range	30.20560 ohm		29.79440 ohm		
9	300 Ohm	300 Ohm Range	300.2200 ohm		299.7800 ohm		
10	3 KOhm	3 KOhm Range	3.000357 Kohm		2.999643 Kohm		
11	30 KOhm	30 KOhm Range	30.00177 Kohm		29.99823 Kohm		
12	300 KOhm	300 KOhm Range	300.0160 Kohm		299.9840 Kohm		
13	3 MOhm	3 MOhm Range	3.000209 Mohm		2.999791 Mohm		
14	30 MOhm	30 MOhm Range	30.01283 Mohm		29.98717 Mohm		

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature________

4-WIRE OHMS TEST

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	OFFSET TEST						
1	Short	30 Ohm Range	+ 00.00335 ohm		- 00.00335 ohm		
2	Short	300 Ohm Range	+ 000.0035 ohm		- 000.0035 ohm		
3	Short	3 KOhm Range	+ 0.000007 Kohm		- 0.000007 Kohm		
4	Short	30 KOhm Range	+ 00.00007 Kohm		- 00.00007 Kohm		
5	Short	300 KOhm Range	+ 000.0008 Kohm		- 000.0008 Kohm		
6	Short	3 MOhm Range	+ 0.000014 Mohm		- 0.000014 Mohm		
7	Short	30 MOhm Range	+ 00.00083 Mohm		- 00.00083 Mohm		
	GAIN TEST						
8	30 Ohm	30 Ohm Range	30.00560 ohm		29.99440 ohm		
9	300 Ohm	300 Ohm Range	300.0200 ohm		299.9800 ohm		
10	3 KOhm	3 KOhm Range	3.000157 Kohm		2.999843 Kohm		
11	30 KOhm	30 KOhm Range	30.00157 Kohm		29.99843 Kohm		
12	300 KOhm	300 KOhm Range	300.0158 Kohm		299.9842 Kohm		
13	3 MOhm	3 MOhm Range	3.000209 Mohm		2.999791 Mohm		
14	30 MOhm	30 MOhm Range	30.01283 Mohm		29.98717 Mohm		

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature________

REAR INPUT TESTS (STANDARD INSTRUMENT)

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	DC VOLTAGE OFFSET TEST (Rear Terminals)						
1	Short	300 V Range	+ 000.0007 V		- 000.0007 V		
2	Short	30 V Range	+ 00.00020 V		- 00.00020 V		
3	Short	3 V Range	+ 0.000007 V		- 0.000007 V		
4	Short	300 mV Range	+ 000.0040 mV		- 000.0040 mV		
5	Short	30 mV Range	+ 00.00385 mV		- 00.00385 mV		
	DC CURRENT OFFSET TEST (Rear Terminals)						
6	Open	300 uADCI Range	+ 000.0104 uA		- 000.0104 uA		
7	Open	3 mADCI Range	+ 0.000104 mA		- 0.000104 mA		
8	Open	30 mADCI Range	+ 00.00104 mA		- 00.00104 mA		
9	Open	300 mADCI Range	+ 000.0204 mA		- 000.0204 mA		
10	Open	1 ADCI Range	+ 0.000604 A		- 0.000604 A		
	2-WIRE OHMS OFFSET TEST (Rear Terminals)						
11	Short	30 Ohm Range	+ 00.20335 ohm		- 00.20335 ohm		
12	Short	300 Ohm Range	+ 000.2035 ohm		- 000.2035 ohm		
13	Short	3 KOhm Range	+ 0.000207 Kohm		- 0.000207 Kohm		
14	Short	30 KOhm Range	+ 00.00027 Kohm		- 00.00027 Kohm		
15	Short	300 KOhm Range	+ 000.0010 Kohm		- 000.0010 Kohm		
16	Short	3 MOhm Range	+ 0.000014 Mohm		- 0.000014 Mohm		
17	Short	30 MOhm Range	+ 00.00083 Mohm		- 00.00083 Mohm		

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number____________

Test Performed by ____________
Date __________
Reference Temperature_________

REAR INPUT TESTS (STANDARD INSTRUMENT)

Step#	Input to 3457A	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	4-WIRE OHMS OFFSET TEST (Rear Terminals)						
18	Short	30 Ohm Range	+ 00.00335 ohm	__________	- 00.00335 ohm	____	____
19	Short	300 Ohm Range	+ 000.0035 ohm	__________	- 000.0035 ohm	____	____
20	Short	3 KOhm Range	+ 0.000007 Kohm	__________	- 0.000007 Kohm	____	____
21	Short	30 KOhm Range	+ 00.00007 Kohm	__________	- 00.00007 Kohm	____	____
22	Short	300 KOhm Range	+ 000.0008 Kohm	__________	- 000.0008 Kohm	____	____
23	Short	3 MOhm Range	+ 0.000014 Mohm	__________	- 0.000014 Mohm	____	____
24	Short	30 MOhm Range	+ 00.00083 Mohm	__________	- 00.00083 Mohm	____	____

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature_________

REAR INPUT TESTS (44491A General Purpose Relay Assy)

Step#	3457 Input	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	DC VOLTAGE OFFSET TEST (44491A)						
1	Short	300 V Rng (Chan 0)	+ 000.0007 V		- 000.0007 V		
2	Short	30 V Rng (Chan 0)	+ 00.00020 V		- 00.00020 V		
3	Short	3 V Rng (Chan 0)	+ 0.000010 V		- 0.000010 V		
4	Short	300 mV Rng (Chan 0)	+ 000.0070 mV		- 000.0070 mV		
5	Short	30 mV Rng (Chan 0)	+ 00.00685 mV		- 00.00685 mV		
6	Short	30 mV Rng (Chan 1)	+ 00.00685 mV		- 00.00685 mV		
7	Short	30 mV Rng (Chan 2)	+ 00.00685 mV		- 00.00685 mV		
8	Short	30 mV Rng (Chan 3)	+ 00.00685 mV		- 00.00685 mV		
9	Short	30 mV Rng (Chan 4)	+ 00.00685 mV		- 00.00685 mV		
10	Short	30 mV Rng (Chan 5)	+ 00.00685 mV		- 00.00685 mV		
11	Short	30 mV Rng (Chan 6)	+ 00.00685 mV		- 00.00685 mV		
12	Short	30 mV Rng (Chan 7)	+ 00.00685 mV		- 00.00685 mV		
	2-WIRE OHMS OFFSET TEST (44491A)						
13	Short	30 MOhm Rng (Chan 0)	+ 00.00086 MOhm		- 00.00086 MOhm		
14	Short	3 MOhm Rng (Chan 0)	+ 0.000019 MOhm		- 0.000019 MOhm		
15	Short	300 KOhm Rng (Chan 0)	+ 000.0033 KOhm		- 000.0033 KOhm		
16	Short	30 KOhm Rng (Chan 0)	+ 00.00230 KOhm		- 00.00230 KOhm		
17	Short	3 KOhm Rng (Chan 0)	+ 0.002210 KOhm		- 0.002210 KOhm		
18	Short	300 Ohm Rng (Chan 0)	+ 002.2065 Ohm		- 002.2065 Ohm		
19	Short	30 Ohm Rng (Chan 0)	+ 02.20635 Ohm		- 02.20635 Ohm		

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature________

REAR INPUT TESTS (44491A General Purpose Relay Assy)

Step#	3457 Input	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
20	Short	30 Ohm Rng (Chan 1)	+ 02.20635 Ohm		- 02.20635 Ohm		
21	Short	30 Ohm Rng (Chan 2)	+ 02.20635 Ohm		- 02.20635 Ohm		
22	Short	30 Ohm Rng (Chan 3)	+ 02.20635 Ohm		- 02.20635 Ohm		
23	Short	30 Ohm Rng (Chan 4)	+ 02.20635 Ohm		- 02.20635 Ohm		
24	Short	30 Ohm Rng (Chan 5)	+ 02.20635 Ohm		- 02.20635 Ohm		
25	Short	30 Ohm Rng (Chan 6)	+ 02.20635 Ohm		- 02.20635 Ohm		
26	Short	30 Ohm Rng (Chan 7)	+ 02.20635 Ohm		- 02.20635 Ohm		
	4-WIRE OHMS OFFSET TEST (44491A)						
27	Short	30 Ohm Rng (Chan 10)	+ 00.00635 Ohm		- 00.00635 Ohm		
28	Short	300 Ohm Rng (Chan 10)	+ 000.0065 Ohm		- 000.0065 Ohm		
29	Short	3 KOhm Rng (Chan 10)	+ 0.000010 KOhm		- 0.000010 KOhm		
30	Short	30 KOhm Rng (Chan 10)	+ 00.00010 KOhm		- 00.00010 KOhm		
31	Short	300 KOhm Rng (Chan 10)	+ 000.0011 KOhm		- 000.0011 KOhm		
32	Short	3 MOhm Rng (Chan 10)	+ 0.000017 MOhm		- 0.000017 MOhm		
33	Short	30 MOhm Rng (Chan 10)	+ 00.00086 MOhm		- 00.00086 MOhm		
	DC CURRENT OFFSET TEST (44491A)						
34	Open	300 uA Range	+ 000.0104 uA		- 000.0104 uA		
35	Open	3 mA Range	+ 0.000104 mA		- 0.000104 mA		
36	Open	30 mA Range	+ 00.00104 mA		- 00.00104 mA		
37	Open	300 mA Range	+ 000.0204 mA		- 000.0204 mA		
38	Open	3 A Range	+ 0.000604 A		- 0.000604 A		

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number______________

Test Performed by ____________
Date __________
Reference Temperature_________

REAR INPUT TESTS (44492A 10 Channel Multiplex Assy)

Step#	3457 Input	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	DC VOLTAGE OFFSET TEST (44492A)						
1	Short	300 V Rng (Chan 0)	+ 000.0007 V		- 000.0007 V		
2	Short	30 V Rng (Chan 0)	+ 00.00020 V		- 00.00020 V		
3	Short	3 V Rng (Chan 0)	+ 0.000010 V		- 0.000010 V		
4	Short	300 mV Rng (Chan 0)	+ 000.0070 mV		- 000.0070 mV		
5	Short	300 mV Rng (Chan 1)	+ 000.0070 mV		- 000.0070 mV		
6	Short	300 mV Rng (Chan 2)	+ 000.0070 mV		- 000.0070 mV		
7	Short	300 mV Rng (Chan 3)	+ 000.0070 mV		- 000.0070 mV		
8	Short	300 mV Rng (Chan 4)	+ 000.0070 mV		- 000.0070 mV		
9	Short	300 mV Rng (Chan 5)	+ 000.0070 mV		- 000.0070 mV		
10	Short	300 mV Rng (Chan 6)	+ 000.0070 mV		- 000.0070 mV		
11	Short	300 mV Rng (Chan 7)	+ 000.0070 mV		- 000.0070 mV		
12	Short	300 mV Rng (Chan 8)	+ 000.0070 mV		- 000.0070 mV		
13	Short	300 mV Rng (Chan 9)	+ 000.0070 mV		- 000.0070 mV		
	2-WIRE OHMS OFFSET TEST (44492A)						
14	Short	30 MOhm Rng (Chan 0)	+ 00.00086 KOhm		- 00.00086 KOhm		
15	Short	3 MOhm Rng (Chan 0)	+ 0.000021 MOhm		- 0.000021 MOhm		
16	Short	300 KOhm Rng (Chan 0)	+ 000.0033 KOhm		- 000.0033 KOhm		
17	Short	30 KOhm Rng (Chan 0)	+ 00.00230 KOhm		- 00.00230 KOhm		
18	Short	3 KOhm Rng (Chan 0)	+ 0.002210 KOhm		- 0.002210 KOhm		
19	Short	300 Ohm Rng (Chan 0)	+ 004.2065 Ohm		- 004.2065 Ohm		
20	Short	300 Ohm Rng (Chan 1)	+ 004.2065 Ohm		- 004.2065 Ohm		

PERFORMANCE TEST CARD
1 YEAR LIMITS

Hewlett-Packard Model 3457A
Digital Mutimeter
Serial Number_______________

Test Performed by ____________
Date __________
Reference Temperature_________

REAR INPUT TESTS (44492A 10 Channel Multiplex Assy)

Step#	3457 Input	Set-Up and Configuration	High Limit	Reading	Low Limit	Test Pass	Test Fail
	2-WIRE OHMS OFFSET TEST (44492A) CONT'D						
21	Short	300 Ohm Rng (Chan 2)	+ 004.2065 Ohm	_______________	- 004.2065 Ohm	______	______
22	Short	300 Ohm Rng (Chan 3)	+ 004.2065 Ohm	_______________	- 004.2065 Ohm	______	______
23	Short	300 Ohm Rng (Chan 4)	+ 004.2065 Ohm	_______________	- 004.2065 Ohm	______	______
24	Short	300 Ohm Rng (Chan 5)	+ 004.2065 Ohm	_______________	- 004.2065 Ohm	______	______
25	Short	300 Ohm Rng (Chan 6)	+ 004.2065 Ohm	_______________	- 004.2065 Ohm	______	______
26	Short	300 Ohm Rng (Chan 7)	+ 004.2065 Ohm	_______________	- 004.2065 Ohm	______	______
27	Short	300 Ohm Rng (Chan 8)	+ 004.2065 Ohm	_______________	- 004.2065 Ohm	______	______
28	Short	300 Ohm Rng (Chan 9)	+ 004.2065 Ohm	_______________	- 004.2065 Ohm	______	______

SECTION V
CALIBRATION

WARNING

The information contained in this section is intended for the use of service trained personnel who understand electronic circuitry and are aware of the hazards involved. Do not attempt to perform any of the procedures outlined in this section unless you are qualified to do so.

5-1. INTRODUCTION

5-2. Section V contains Manual Calibration Procedures for the HP 3457A Multimeter. Section V also contains information explaining the Calibration Security features built into the 3457A. The 3457A has only two screwdriver adjustments which, under normal conditions, do not require adjusting. All calibration is accomplished from the front panel or through computer control.

5-3. An Automatic Calibration procedure, which includes software and instructions, is available by ordering HP Part Number 03457-10085 (for use with the HP Model 85B) or 03457-10200 (for use with the HP Series 200 computer). The equipment listed below is preferred for use with the Automatic Calibration Procedure, however, other equipment may be used.

Controller	HP Model 85B Computer or HP Series 200 Computer
Frequency Counter	HP 5314A or HP 3457A
DC Voltage/Current Resistance Calibrator	Datron 4000A
AC Voltage/Current/Frequency Calibrator	Datron 4200

5-4. CALIBRATION SECURITY

5-5. The Calibration Security feature of the 3457A allows the person responsible for calibration of the unit to enter a Security Code to prevent accidental or unauthorized calibration.

5-6. Security Code

5-7. The Security Code is a six digit integer number from 0 through 999,999 (if the number entered is not an integer number, it will be rounded to an integer value and then used). The instrument is shipped from the factory with the Security Code set to 3457. Setting the code to zero disables the security feature.

5-8. Changing the Security Code (SECURE <old security code> , <new security code>). The procedure for changing the Security Code is as follows:

a. Access the SECURE command. ***(Press the Blue SHIFT key, then the RECALL / S configuration key. Use the ↓ scroll key to display the SECURE command).***

b. Enter the old Security Code, the delimiter (,) and the new Security Code. ***(The instrument is shipped from the factory with the security code set to 3457).*** Example: To change the Security Code from 3457 to 7543, enter 3457 , 7543.

c. Press the ENT key. The instrument will now respond to the new Security Code.

5-9. In the event that the security code is unknown, the security feature can be disabled to permit a new code to be entered. To disable the security feature, complete the following steps.

a. Remove all power from the 3457A (line cord and external inputs) and turn the unit upside-down.

b. Loosen the six captive screws in the bottom cover. ***(It is not necessary to remove these screws from the bottom cover).***

c. Return the unit to an upright position and remove the top cover.

d. Remove the NORM / DSA / KEY jumper (JM532) from the NORM position and place it in the KEY position. ***(JM532 is located on the A1 logic board directly behind the front panel display).***

e. Reconnect the power and turn the instrument ON.

f. Access the SECURE command. ***(Press the Blue SHIFT key then the RECALL / S configuration key. Use the ↓ scroll key to display the SECURE command).***

g. Enter the number 0, the delimiter (,) and the security number you wish to use.

h. Press the ENT key.

i. Disconnect power and return jumper JM532 to the NORM position.

j. Replace the top cover, tighten the retaining screws and reconnect the power. The instrument will now respond to the security code just entered.

NOTE

When jumper JM532 is in the KEY position, the security feature is disabled. It is possible to calibrate the instrument without entering a security number under these conditions. If a new security number is not entered while the jumper is in the KEY position, the original number will again be in effect when jumper JM532 is returned to the NORM position.

5-10. Calibration Number (CALNUM?)

5-11. The CALNUM? command provides you with a method of monitoring the number of calibrations performed. By using this command, you can determine whether un-authorized calibrations have occurred. The instrument will always respond the CALNUM query command by displaying the number of calibration RAM entries completed since factory initialization. factory initialization. The maximum calibration number which can be stored is 32767. After reaching the maximum number, the counter resets to 0 and begins again. Please note that the calibration number is increased by one for each calibration point. A complete calibration increases the calibration number by several digits.

5-12. The procedure for reading the Calibration Number is as follows:

a. Access the CALNUM? command. ***(Press the Blue SHIFT key then the OFFSET COMP / C configuration key. Use the ↓ scroll key to display the CALNUM? command).***

b. Press the ENT key.

c. The display will show CALNUM? and the current calibration number.

d. Press any key to return the instrument to normal operation.

5-13. PRELIMINARY CALIBRATION PROCEDURES

5-14. The following steps should be performed prior to calibration of the 3457A:

a. Select the calibration area. The 3457A may be calibrated in a "bench" environment or in a system cabinet. For greatest accuracy, select an area where the temperature is between 18 °C and 28 °C and stable within ±5 °C.

b. Connect the 3457A to an appropriate power source and turn the instrument ON. The 3457A can operate on line voltages from 100 Vac to 240 Vac, 50 Hz or 60 Hz. Refer to Section II, Line Voltage Selection, for proper rear panel switch settings and fuse selection.

c. Remove all external input signals from the front and rear/scanner input terminals.

d. Run the instrument Self Test. *(Press the Blue SHIFT key then the ← / TEST key). The display will show* TESTING while the test routine is running.

1. If the display shows SELF TEST OK after the test has completed, continue with step " e ".

2. If the display shows TEST FAILED, check the ERROR message. *(Press the Blue SHIFT key then the - / ERROR key).*

   - If the Error Message reads OUT OF CALIBRATION, continue with step " e ". *(It is probable that performing the Calibration Procedures will eliminate this error).*

   - If the Error Message reads HARDWARE ERR, check the AUXERR? (Auxiliary Error) message for additional information. *(Press the Blue SHIFT key then the NPLC / A configuration key. Use the ↓ scroll key to display AUXERR. Press the ENT key).*

     ☐ An AUXERR? message of 16 indicates the Input Amplifier Offset is beyond tolerance. Perform the Input Amplifier Offset adjustment (Paragraph 5-15) and repeat steps " d " through " h " of this procedure.

     ☐ An AUXERR? message of 256 indicates the AC attenuator frequency compensation is beyond tolerance. Perform the AC Convertor Frequency Response adjustment (Paragraph 5-17) and repeat steps " d " through " h " of this procedure.

     ☐ An AUXERR? message, other than 16 or 256 indicates a component failure. Refer to Section VIII for repair procedures.

e. Allow the instrument to warm-up for a period of one hour.

f. Run the AUTO CAL (Auto-calibration) routine. *(Press the AUTO CAL configuration key, to display the ACAL command, enter the number 1 and press the ENT key).*

g. Record the Calibration Number if desired. (Refer to paragraph 5-10).

h. Proceed to the calibration procedures beginning at paragraph 5-19.

5-15. Input Amplifier Offset Adjustment

5-16. This adjustment is not required unless the Self Test response is HARDWARE ERR and the AUXERR message is 16. Adjust the Input Amplifier Offset as follows:

a. Remove all power from the 3457A (line cord and external inputs).

b. Loosen the two screws attaching the rear terminal assembly or terminal block assembly to the rear panel and remove the terminal or terminal block assembly.

c. Turn the instrument upside-down and loosen the six captive screws in the bottom cover. *(It is not necessary to remove these screws from the bottom cover).*

d. Return the unit to an upright position and remove the top cover.

e. With the front panel of the instrument facing you, move the plug-in support assembly slightly to the left to release the locking tab and lift the support assembly.

f. Lay the plug-in support assembly over the front panel to gain access to the Input Amplifier adjustment (Vos Adj A2R113).

g. Reconnect power to the instrument and turn it ON.

h. Enable Diagnostic Routine number 4. *(Press the Blue SHIFT key then the AUTO ZERO / D configuration key. Use the ↓ scroll key to display DIAGNOSTIC. Enter the number 4 and press the ENT key).*

i. Use an insulated adjustment tool to adjust A2-R113 (Vos adj) until the display reads PASSED.

j. Exit the Diagnostic Routine. *(Press and hold the → / RESET display key until a tone is heard).*

k. Turn the instrument OFF and remove the power cord.

l. Replace the plug-in support assembly, top cover and terminal or terminal block assembly.

m. Reconnect power and turn the instrument ON.

5-17. AC Convertor Frequency Response Adjustment

5-18. This adjustment is not required unless the Self-Test response is HARDWARE ERR and the AUXERR message is 256. Adjust the AC Convertor Frequency Response as follows:

a. Remove all power from the 3457A (line cord and external inputs).

b. Loosen the two screws attaching the rear terminal assembly or terminal block assembly to the rear panel and remove the terminal or terminal block assembly.

c. Turn the instrument upside-down and loosen the six captive screws in the bottom cover. *(It is not necessary to remove these screws from the bottom cover).*

d. Return the unit to an upright position and remove the top cover.

e. With the front panel of the instrument facing you, move the plug-in support assembly slightly to the left to release the locking tab and lift the support assembly.

f. Lay the plug-in support assembly over the front panel to gain access to the AC convertor frequency response adjustment (Gain/Flatness A3C332).

g. Reconnect power to the instrument and turn it ON.

h. Run the AC Auto-Cal routine. ***(Press the AUTO CAL configuration key, enter the number 2 and press the ENT key).***

i. Enable Diagnostic Routine number 8. ***(Press the Blue SHIFT key then the AUTO ZERO / D configuration key. Use the ↓ scroll key to display DIAGNOSTIC. Enter the number 8 and press the ENT key).***

j. Use an insulated adjustment tool to adjust A3-C332 (Gain/Flatness adj) until the display reads PASSED 0.

k. Exit the Diagnostic Routine. ***(Press and hold the → / RESET display key until a tone is heard).***

l. Turn the instrument OFF and remove the power cord.

m. Replace the plug-in support assembly, top cover and terminal or terminal block assembly.

n. Reconnect power and turn the instrument ON.

5-19. CALIBRATION PROCEDURES - FRONT PANEL INPUTS

5-20. Calibration of the 3457A from the front input terminals consists of calibrating the offset and gain of each range for the DCV, 2-Wire Ohms, 4-Wire Ohms and DCI Functions and gain of each range for the ACV and ACI Functions. The FREQ Function is calibrated at one frequency.

NOTE

The Preliminary Calibration Procedures should be completed before attempting the following procedures.

5-21. DC Volts Offset Calibration - Front Terminals

5-22. Equipment Required. A low thermal short (copper wire) is required for this procedure.

a. Select the DC Voltage Function. ***(Press the DCV function key).***

b. Connect a short between the front panel HI and LO input terminals.

c. Use the following procedure to calibrate the front terminal offset on the 30 mV, 300 mV, 3 V, 30 V and 300 V ranges beginning with the 300 V range and ending on the 30 mV range.

1. Set the 3457A to the appropriate voltage range. ***(Use the ↑ or ↓ scroll key to select the proper voltage range).***

2. Access the Calibration Command. ***(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).*** The display will show CAL.

3. Enter the value of the input; in this case 0. ***(NOTE: If the security feature has not been disabled, (set to 0) it will be necessary to enter the input value, the delimiter (,) and the security code).***

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c4 " for each of the remaining voltage ranges.

e. Remove the short from the front panel HI and LO Input Terminals.

5-23. DC Volts Gain Calibration - Front Terminals

5-24. Equipment Required. A DC Voltage Source capable of providing 30 mV (±.0055%), 300 mV (±.0012%), 3 V (±.0006%), 30 V (±.0013%) and 300 V (±.0017%) is required for the following procedure.

a. Set the HP 3457A to the 300 volt range. *(Use the ↑ scroll key to select the 300 V range).*

b. Connect the Voltage Source to the HP 3457A front panel HI and LO input terminals and set its output to 300 V.

c. Use the following steps to calibrate the DC Voltage Gain on the 300 V, 30 V, 3 V, 300 mV and 30 mV ranges beginning with the 300 V range and ending on the 30 mV range.

1. Set the 3457A to the appropriate voltage range. *(Use the ↑ or ↓ scroll key to select the proper voltage range).*

2. Set the voltage source to an output which will provide a full-scale reading on the HP 3457A.

3. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

4. Enter the value of the input voltage (in volts). *(NOTE: If the security feature has not been disabled, (set to 0) it will be necessary to enter the input value, the delimiter (,) and the security code).*

5. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c5 " for each of the remaining voltage ranges.

e. Set the output of the Voltage Source to 3 volts.

5-25. DC Volts Linearity Calibration - Front Terminals

5-26. Equipment Required. A DC Voltage Source capable of providing 3 V (±.0006%) is required to calibrate linearity of the DC Voltage Function.

a. Set the HP 3457A to the 3 volt range.

b. Set the Voltage Source for an output voltage of 3 Vdc.

c. Reverse the leads at the 3457A input terminals to provide a negative input voltage.

d. Access the Calibration Command. *(Press the Blue SHIFT key then the OFFSET COMP / C configuration key).* The display will will show CAL.

e. Enter the value of the input voltage (in volts), including the polarity. *(NOTE: If the security feature has not been disabled, (set to 0) it will be necessary to enter the input value, the delimiter (,) and the security code).*

f. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

g. Set the output of the Voltage Source to 0 V and disconnect it from the HP 3457A input terminals.

5-27. Two-Wire Ohms Offset Calibration - Front Terminals

5-28. Equipment Required. A low thermal short (copper wire) is required for this procedure.

a. Select the 2-Wire Ohms Function. *(Press the OHM function key).*

b. Connect a short between the Front Panel HI and LO input terminals.

c. Use the following procedure to calibrate the front terminal offset on the 30 ohm, 300 ohm, 3 Kohm, 30 Kohm, 300 Kohm, 3 Mohm and 30 Mohm ranges beginning with the 30 Mohm range.

1. Set the 3457A to the appropriate resistance range. *(Use the ↑ or ↓ scroll key to select the proper range).*

2. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

3. Enter the value of the input resistance - in this case 0. *(NOTE: If the security feature has not been disabled, (set to 0) it will be necessary to enter the input value, the delimiter (,) and the security code).*

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c4 " for each of the remaining ranges.

e. Remove the short from the Front Panel HI and LO Input Terminals.

5-29. Two-Wire Ohms Gain Calibration - Front Terminals

5-30. Equipment Required. Resistance Standards of 30 Ohms (±.2%), 300 Ohms (±.02%), 3 Kohms (±.003%), 30 Kohms (±.001%), 300 Kohms (±.001%), 3 Mohms (±.002%) and 30 Mohms (±.009%) are required to calibrate the 2-Wire Ohms Function.

a. Run the Ohms Auto-Calibration routine. *(Press the AUTO CAL configuration key, enter the number 3 and press the ENT key).*

b. Set the Resistance Standard to 30 MOhms and connect it to the HP 3457A front panel HI and LO input terminals.

c. Use the following procedure to calibrate the Gain on the 30 Mohm, 3 Mohm, 300 Kohm, 30 Kohm, 3 Kohm, 300 Ohm and 30 Ohm ranges beginning with the 30 Mohm range.

1. Set the 3457A to the appropriate Resistance range. *(Use the ↑ or ↓ scroll key to select the proper range).*

2. Set the resistance standard to the full-scale resistance of HP 3457A range selected.

3. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

4. Enter the value of the input resistance (in ohms). *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).* 5. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c5 " for each of the remaining ranges.

e. Disconnect the resistance standard from the 3457A input terminals.

5-31. Four-Wire Ohms Offset Calibration - Front Terminals

5-32. Equipment Required. A low thermal short (copper wire) is required for this procedure. (Refer to Figure 5-1).

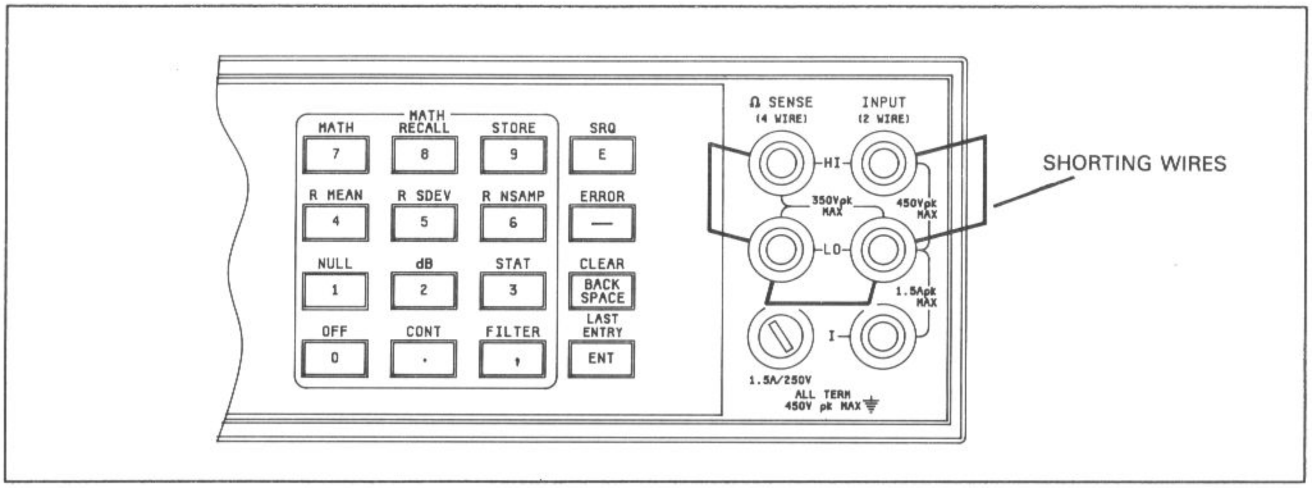

MATH
7
MATH RECALL
8
STORE
9
SRQ
E
R MEAN
4
R SDEV
5
R NSAMP
6
ERROR
—
NULL
1
dB
2
STAT
3
CLEAR
BACK SPACE
OFF
0
CONT
.
FILTER
,
LAST ENTRY
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX
SHORTING WIRES

Figure 5-1. Input Connections for Four-Wire Ohms Offset Calibration

a. Select the 4-Wire Ohms Function. *(Press the Blue SHIFT key, then the OHM / OHMF key).*

b. Connect the short across the Front Panel HI and LO Input Terminals and the Ω Sense HI and LO terminals as shown in Figure 5-1.

c. Use the following procedure to calibrate the front terminal offset on the 30 Mohm, 3 Mohm, 300 Kohm, 30 Kohm, 3 Kohm, 300 Ohm and 30 Ohm ranges beginning with the 30 Mohm range.

1. Set the 3457A to the appropriate resistance range. *(Use the ↑ or ↓ scroll keys to select the proper range).*

2. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

3. Enter the value of the input - in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c4 " for each of the remaining ranges.

e. Remove the shorting wires from the Front Panel Ω Source and Input terminals.

5-33. Four-Wire Ohms Gain Calibration - Front Terminals

5-34. Equipment Required. Resistance Standards capable of providing 30 Ohms (±.2%), 300 Ohms (±.02%), 3 Kohm (±.003%), 30 Kohms (±.001%), 300 Kohms (±.001%), 3 Mohms (±.002%) and 30 Mohms (±.009%) are required to calibrate the 4-Wire Ohms Function.

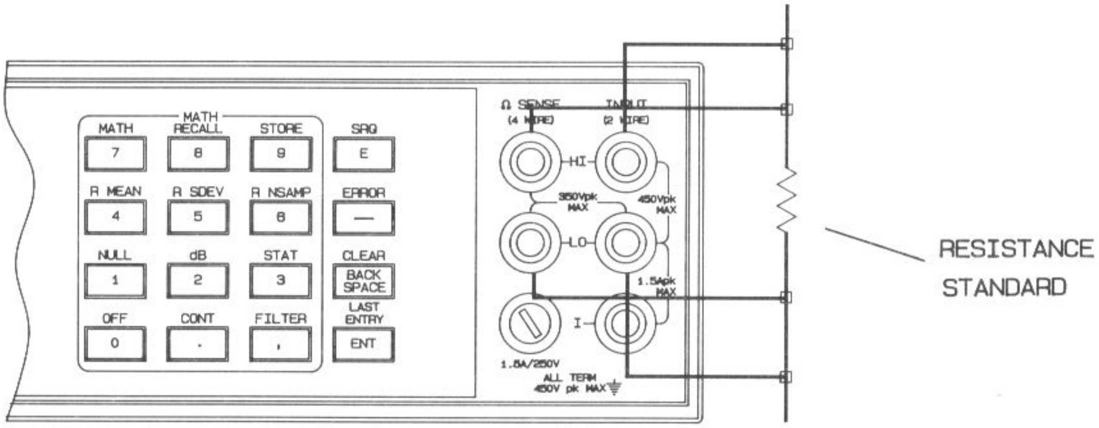

MATH
MATH RECALL
STORE
SRQ
7
8
9
E
R MEAN
R SDEV
R NSAMP
ERROR
4
5
6
—
NULL
dB
STAT
CLEAR
1
2
3
BACK SPACE
OFF
CONT
FILTER
LAST ENTRY
0
.
,
ENT
Ω SENSE (4 WIRE)
INPUT (2 WIRE)
HI
350Vpk MAX
450Vpk MAX
LO
1.5Apk MAX
I
1.5A/250V
ALL TERM 450V pk MAX
RESISTANCE STANDARD

Figure 5-2. Input Connections for 4-Wire Ohms Gain Calibration

a. Run the Ohms Auto-Calibration routine. *(Press the AUTO CAL configuration key, enter the number 3 and press the ENT key).*

b. Set the Resistance Standard to 30 MOhms and connect it to the HP 3457A front panel HI and LO Input terminals and Ω Sense HI and LO terminals as shown in Figure 5-2.

c. Use the following procedure to calibrate the Gain on the 30 Mohm, 3 Mohm, 300 Kohm, 30 Kohm, 3 Kohm, 300 Ohm and 30 Ohm ranges beginning with the 30 Mohm range.

1. Set the 3457A to the appropriate Resistance range. *(Use the ↑ or ↓ scroll key to select the proper range).*

2. Set the resistance standard to the full-scale resistance of HP 3457A range selected.

3. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

4. Enter the value of the input resistance (in ohms). *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

5. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c5 " for each of the remaining ranges.

e. Disconnect the resistance standard from the 3457A input terminals.

5-35. DC Current Offset Calibration - Front Terminals

5-36. Equipment Required. No equipment is needed for this procedure.

a. Be certain all leads are disconnected from the HP 3457A input terminals.

b. Select the DC Current Function. *(Press the DCI function key).*

c. Use the following procedure to calibrate the front terminal offset on the 1 A, 300 mA, 30 mA, 3 mA and 300 uA ranges beginning with the 1 A range.

1. Set the 3457A to the appropriate current range. *(Use the ↑ or ↓ scroll key to select the proper range).*

2. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

3. Enter the value of the input - in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c4 " for each of the remaining ranges.

5-37. DC Current Gain Calibration - Front Terminals

5-38. Equipment Required. A DC Current Source capable of providing 300 uA, 3 mA, 30 mA (±.007%), 300 mA (±.026%) and 1 A (±.04%) is required to calibrate the DC Current Function.

a. Connect the Current Source to the HP 3457A front panel **I** and **LO** input terminals. Set the output of the Current Source to 1 A.

b. Use the following procedure to calibrate the front terminal gain on the 1 A, 300 mA, 30 mA, 3 mA and 300 uA ranges beginning with the 1 A range.

1. Set the 3457A to the appropriate current range. *(Use the ↑ or ↓ scroll key to select the proper range).*

2. Set the current source to provide a full-scale reading on the HP 3457A range selected.

3. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

4. Enter the value of the input current (in amps). *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

5. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

c. Repeat steps " b1 " through " b4 " for each of the remaining ranges.

5-39. AC Volts Offset & Gain Calibration - Front Terminals

5-40. Equipment Required. An AC Voltage Source capable of providing 30 mVrms, 300 mVrms, 1 Vrms, 2 Vrms, 3 Vrms, 30 Vrms and 300 Vrms (±0.1%) at a frequency of 1 KHz is required to calibrate the AC Voltage Function.

a. Select the AC Voltage function. *(Press the ACV function key).*

b. Run the AC Auto-Calibration routine. *(Press the AUTO CAL configuration key, enter the number 2 and press the ENT key).*

c. Set the AC Voltage Source to provide a 3 volt, 1 kHz signal and connect it to the front panel HI and LO input terminals.

NOTE

The 3457A must be calibrated on the 3 volt range before calibrating the other ranges. This is because the offset constant for all ac voltage and ac current ranges is computed while calibrating the 3 Vac range.

d. Set the 3457A to the 3 volt range. *(Use the ↑ or ↓ scroll keys to select the proper range).*

e. Use the following procedure to calibrate the Gain on the 30 mV, 300 mV, 3 V, 30 V and 300 V AC ranges beginning with the 3 V range.

1. Set the 3457A to the appropriate voltage range. *(Use the ↑ or ↓ scroll key to select the proper range).*

2. Set the output of the AC voltage source to provide a full-scale reading on the HP 3457A.

3. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

4. Enter the value of the input voltage (in volts). *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

5. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

f. Repeat steps " e1 " through " e4 " for each of the remaining ranges.

g. Set the output of the AC Voltage Source to 0 and disconnect it from HP the 3457A.

5-41. AC Current Calibration - Front Terminals

5-42. Equipment Required. An AC Current Source capable of providing 30 mA (±.14%), 300 mA (±.14%) and 1 A (±.24%) at a frequency of 1 KHz is required to calibrate the AC Current Function.

a. Select the AC Current function. *(Press the ACI function key).*

b. Set the AC Current Source to provide an output of 30 mA and connect it to the HP 3457A front panel **I** and **LO** input terminals.

c. Use the following procedure to calibrate the AC Current function on the 30 mA, 300 mA and 1 A ranges beginning with the 30 mA range.

1. Set the 3457A to the appropriate current range. *(Use the ↑ or ↓ scroll key to select the proper range).*

2. Set the current source to provide a full-scale reading on the HP 3457A range selected.

3. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

4. Enter the value of the input current (in amps). *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

5. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c5 " for each of the remaining ranges.

e. Set the Current Source for an output of 0 and disconnect it from the HP 3457A.

5-43. Frequency Calibration - Front Terminals

5-44. Equipment Required. A Frequency Generator capable of providing a single sine-wave signal between 100 Hz and 1 MHz with a frequency accuracy of ±.003%) is required to calibrate the Frequency Function.

a. Set the 3457A to the Frequency function. *(Press the FREQ function key).*

b. Set the Frequency Source to a known frequency between 100 Hz and 1 MHz and connect it to the HP 3457A front panel HI and LO input terminals.

c. Access the Calibration command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

d. Enter the value of the input frequency (in hertz). *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input frequency, the delimiter (,) and the security code).*

e. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

f. Disconnect the Frequency Source from the HP 3457A.

5-45. CALIBRATION PROCEDURES - REAR PANEL INPUTS

5-46. The following paragraphs describe the calibration process for the HP 3457A rear panel inputs. Separate procedures are provided for the standard instrument (Rear Input Terminals), and instruments equipped with optional plug-in assemblies 44491A (General Purpose Relay Assembly) and 44492A (Reed Relay Multiplex Assembly). Select the procedure which applies to your instrument.

5-47. DC Volts Offset Calibration - Rear Terminals (Standard Instrument)

5-48. Equipment Required. A low thermal short (copper wire) is required for this procedure.

a. Short the Ω SENSE HI and LO and INPUT HI and LO rear input terminals together.

b. Select the rear input terminals. *(Press the TERM configuration key, enter the number 2 and press the ENT key).*

c. Select the DC Voltage function. *(Press the DCV function key).*

d. Use the following procedure to calibrate the rear terminal offset on the 300 V, 30 V, 3 V, 300 mV, and 30 mV ranges beginning with the 300 V range.

1. Set the 3457A to the appropriate voltage range. *(Use the ↑ or ↓ scroll key to select the proper voltage range).*

2. Access the Calibration command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

3. Enter the value of the input - in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

e. Repeat steps " d1 " through " d4 " for each of the remaining voltage ranges.

5-49. Two-Wire Ohms Offset Calibration - Rear Terminals (Standard Instrument)

5-50. Equipment Required. A low thermal short is required for this procedure.

a. Short the Ω SENSE HI and LO and INPUT HI and LO rear input terminals together.

b. Select the rear input terminals. *(Press the TERM configuration key, enter the number 2 and press the ENT key).*

c. Select the 2-Wire Ohms function. *(Press the OHM function key).*

d. Use the following procedure to calibrate the rear terminal offset on the 30 Mohm, 3 Mohm, 300 Kohm, 30 Kohm, 3 Kohm, 300 Ohm and 30 Ohm ranges beginning with the 30 Mohm range.

1. Set the 3457A to the appropriate resistance range. *(Use the ↑ or ↓ scroll key to select the proper range).*

2. Access the Calibration command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

3. Enter the value of the input; in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

e. Repeat steps " d1 " through " d4 " for each of the remaining ranges.

5-51. Four-Wire Ohms Offset Calibration - Rear Terminals (Standard Instrument)

5-52. Equipment Required. A low thermal short (copper wire) is required for this procedure.

a. Short the → SENSE HI and LO and INPUT HI and LO rear input terminals together.

b. Select the rear input terminals. *(Press the TERM configuration key, enter the number 2 and press the ENT key).*

c. Select the 4-Wire Ohms function. *(Press the Blue SHIFT key, then the OHM / OHMF function key).*

d. Use the following procedure to calibrate the rear terminal offset on the 30 Mohm, 3 Mohm, 300 Kohm, 30 Kohm, 3 Kohm, 300 Ohm and 30 Ohm ranges beginning with the 30 Mohm range.

1. Set the 3457A to the appropriate resistance range. *(Use the ↑ or ↓ scroll key to select the proper range).*
2. Access the Calibration command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.
3. Enter the value of the input - in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*
4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

e. Repeat steps " d1 " through " d4 " for each of the remaining ranges.

5-53. DC Current Offset Calibration - Rear Terminals (Standard Instrument)

5-54. Equipment Required. No equipment is needed for this procedure.

a. Select the rear input terminals. *(Press the TERM configuration key, enter the number 2 and press the ENT key).*

b. Select the DC Current function. *(Press the DCI function key).*

c. Use the following procedure to calibrate the rear terminal offset on the 300 uA, 3 mA, 30 mA, 300 mA, and 3 A ranges beginning with the 3 A range.

1. Set the 3457A to the appropriate current range. *(Use the ↑ or ↓ scroll key to select the proper range).*
2. Access the Calibration command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.
3. Enter the value of the input - in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*
4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c4 " for each of the remaining ranges.

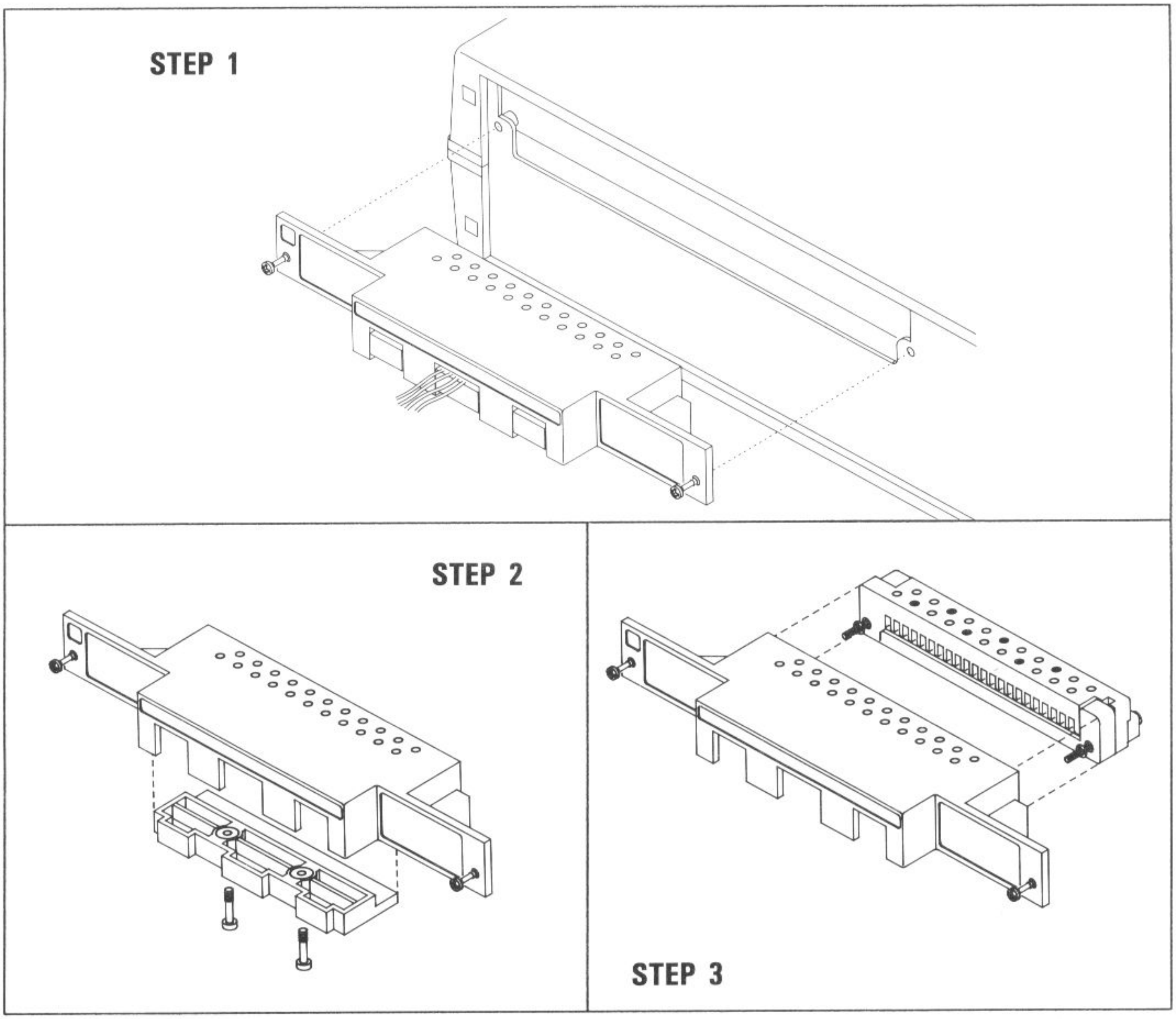


Figure 5-3. Terminal Block Removal

5-55. CALIBRATION PROCEDURES - HP 44491A GENERAL PURPOSE RELAY ASSEMBLY

5-56. Wiring Block Preparation

5-57. It will be necessary to connect shorting wires to the Plug-In Assembly Wiring Block before calibration can be performed. The following procedures outline the wiring block preparation.

WARNING

This procedure assumes that the Wiring Block is new and has no wires connected to it. If the Wiring Block is connected to an external device, hazardous voltages may be exposed when the Strain Relief/Wiring Block Assembly is removed.

a. Remove the two screws attaching the Strain Relief/Wiring Block Assembly to the rear panel and disconnect it from the instrument. (Refer to Figure 5-3, Step 1).

b. Remove the Strain Relief Plate from the bottom of the Strain Relief Assembly (Figure 5-3, Step 2).

c. Remove the Wiring Block from the Strain Relief Housing (Figure 5-3, Step 3).

d. Install copper shorting wires from INput HI to INput LO, from INput HI to Ω Sense HI, and from INput LO to Ω Sense LO on 4-Wire Ω input channel 10. Securely tighten the appropriate retaining screws. (Refer to Figure 5-4 for wire connections).

e. Connect the prepared Wiring Block Assembly to the HP 44491A General Purpose Relay Assembly.

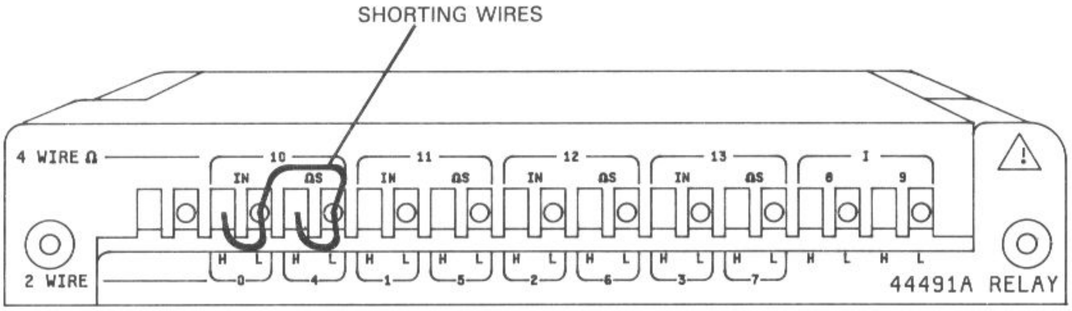


Figure 5-4. 44491A Wiring Block Connections

5-58. DC Volts Offset Calibration - HP 44491A

a. Select the DC Voltage function. *(Press the DCV function key).*

b. Select the Scanner Input. *(Press the TERM configuration key, enter the number 2 and press the ENT key).*

c. Select channel 0. *(Press the CHAN configuration key, enter the number 0 and press the ENT key).*

d. Use the following procedure to calibrate the DC offset on the 300 V, 30 V, 3 V, 300 mV and 30 mV ranges beginning with the 300 V range.

1. Set the 3457A to the appropriate range. *(Use the ↑ or ↓ scroll keys to select the proper range).*

2. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

3. Enter the value of the input - in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

e. Repeat steps " d1 " through " d4 " for each of the remaining ranges.

5-59. Two-Wire Ohms Offset Calibration - HP 44491A

a. Select the 2-Wire Ohms function. *(Press the OHM function key).*

b. Close channel 0. *(Press the CHAN configuration key, enter the number 0 and press the ENT key).*

c. Use the following procedure to calibrate the 2-wire ohm offset on the 30 Mohm, 3 Mohm, 300 Kohm, 30 Kohm, 3 Kohm, 300 Ohm and 30 Ohm ranges beginning with the 30 Mohm range.

1. Set the 3457A to the appropriate resistance range. *(Use the ↑ or ↓ scroll keys to select the proper range).*

2. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

3. Enter the value of the input - in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c4 " for each of the remaining ranges.

5-60. Four-Wire Ohms Offset Calibration - HP 44491A

a. Select the 4-Wire Ohms function. *(Press the Blue SHIFT key then the OHM / OHMF function key).*

b. Close channel 10. *(Press the CHAN configuration key, enter the number 10 and press the ENT key).*

c. Use the following procedure to calibrate the 4-Wire ohm offset on the 30 Mohm, 3 Mohm, 300 Kohm, 30 Kohm, 3 Kohm, 300 Ohm and 30 Ohm ranges beginning with the 30 Mohm range.

1. Set the 3457A to the appropriate resistance range. *(Use the ↑ or ↓ scroll keys to select the proper range).*

2. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

3. Enter the value of the input - in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c4 " for each of the remaining ranges.

5-61. DC Current Offset Calibration - HP 44491A

a. Select the DC Current function. *(Press the DCI function key.)*

b. Select the Scanner Input. *(Press the TERM configuration key, enter the number 2, and press the ENT key.)*

c. Use the following procedures to calibrate the DC Current offset on the 300 uA, 3 mA, 30 mA, 300 mA and 3 A ranges beginning with the 3 A range.

1. Set the 3457A to the appropriate current range. *(Use the ↑ or ↓ scroll key to select the proper range.)*

2. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key.)* The display will show CAL.

3. Enter the value of the input - in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code.)*

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

e. Repeat steps " c1 " through " c4 " for each of the remaining ranges.

5-62. CALIBRATION PROCEDURES - HP 44492A 10 CHANNEL MULTIPLEXER ASSEMBLY

5-63. Wiring Block Preparation

5-64. It will be necessary to connect a shorting wire to the Plug-In Assembly Wiring Block before calibration can be performed. The following procedure outlines the wiring block preparation.

WARNING

This procedure assumes that the Wiring Block is new and has no wires connected to it. If the Wiring Block is connected to an external device, hazardous voltages may be exposed when the Strain Relief/Wiring Block Assembly is removed.

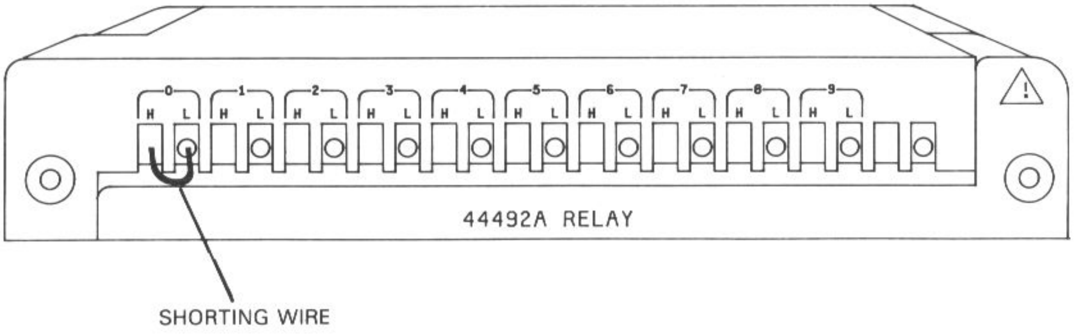


Figure 5-5. 44492A Wiring Block Connections

a. Remove the two screws attaching the Strain Relief/Wiring Block Assembly to the rear panel and disconnect it from the instrument. (Refer to Figure 5-3, Step 1).

b. Remove the Strain Relief Plate from the bottom of the Strain Relief Assembly (Figure 5-3, Step 2).

c. Remove the Wiring Block from the Strain Relief Housing (Figure 5-3, Step 3).

d. Install a copper shorting wire between the H and L inputs of channel 0. Tighten the two retaining screws. (Refer to Figure 5-5 for wire connection).

e. Connect the prepared Wiring Block Assembly to the HP 44492A 10 Channel Multiplexer Assembly.

5-65. DC Volts Offset Calibration - HP 44492A

a. Select the DC Voltage function. *(Press the DCV function key).*

b. Select the Scanner Input. *(Press the TERM configuration key, enter the number 2 and press the ENT key).*

c. Select channel 0. *(Press the CHAN configuration key, enter the number 0 and press the ENT key).*

d. Use the following procedure to calibrate the DC offset on the 300 V, 30 V, 3 V, 300 mV and 30 mV ranges beginning with the 300 V range.

1. Set the 3457A to the appropriate range. *(Use the ↑ or ↓ scroll keys to select the proper range).*

2. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

3. Enter the value of the input - in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

e. Repeat steps " d1 " through " d4 " for each of the remaining ranges.

5-64. Two-Wire Ohms Offset Calibration - HP 44492A

a. Select the 2-Wire Ohms function. *(Press the OHM function key).*

b. Close channel 0. *(Press the CHAN configuration key, enter the number 0 and press the ENT key).*

c. Use the following procedure to calibrate the 2-wire ohm offset on the 30 Mohm, 3 Mohm, 300 Kohm, 30 Kohm, 3 Kohm and 300 Ohm ranges beginning with the 30 Mohm range.

1. Set the 3457A to the appropriate resistance range. *(Use the ↑ or ↓ scroll keys to select the proper range).*

2. Access the Calibration Command. *(Press the Blue SHIFT key, then the OFFSET COMP / C configuration key).* The display will show CAL.

3. Enter the value of the input - in this case 0. *(NOTE: If the security feature has not been disabled (set to 0), it will be necessary to enter the input value, the delimiter (,) and the security code).*

4. Press the ENT key. The display will show CALIBRATING while the calibration routine is running.

d. Repeat steps " c1 " through " c4 " for each of the remaining ranges.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. Tables 6-2 through 6-4 lists the electrical and mechanical parts in alphanumeric order of their reference designators and includes the reference designator, HP part number, quantity used, part description (Refer to abbreviations listed in Table 6-1), a five-digit manufacturer's code and the manufacturer's part number for each part. Table 6-5 lists modifications and part changes. This section also includes disassembly/assembly procedures for replacement of mechanical parts and printed circuit assemblies.

6-3. ORDERING INFORMATION

6-4. Listed Parts

6-5. To obtain a part listed in the Replaceable Parts table, quote the *Hewlett-Packard* part number, the quantity required, and address the order to the nearest *Hewlett-Packard* Office. (Office Locations are listed at the back of this manual.)

6-6. Non-Listed Parts

6-7. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, description and function of the part, and number of parts required. Address the order to the nearest *Hewlett-Packard* Office.

6-8. Direct Mail Order System

6-9. Within the USA, *Hewlett-Packard* can supply parts through a direct mail order system. Advantages of using the system are:

a. Direct ordering and shipment from the HP Parts Center.

b. No maximum or minimum order amount on any mail order (there is a minimum order amount for parts ordered through a local HP office when the orders require billing and invoicing).

c. Prepaid transportation (there is a small handling charge for each order).

d. No invoices - to provide these advantages, a check, money order or VISA or Mastercard number (with expiration date) must accompany each order.

6-10. Mail order forms and specific ordering information is available through your local HP office. Addresses and phone numbers are listed at the back of this manual.

6-11. PART CHANGES

6-12. Components which have been changed are so marked by one of three symbols; a delta (Δ), a delta with a letter subscript (Δ_a) or a delta with a numeric subscript (Δ_{10}). A delta with no subscript indicates the component listed is the preferred replacement for an earlier component. A delta with a letter subscript indicates a change which is explained in a note at the bottom of the page. A delta with a numeric subscript indicates the related change is discussed in backdating (Section VII). The number of the subscript indicates the change number in the backdating section.

6-13. PROPRIETARY PARTS

6-14. Items marked by a dagger (†) in the reference designator column are available only for repair and service of *Hewlett-Packard* instruments.

Table 6-1. Standard Abbreviations

Ag	silver
Al	aluminum
A	ampere(s)
Au	gold
C	capacitor
cer	ceramic
coef	coefficient
com	common
comp	composition
conn	connection
dep	deposited
DPDT	double-pole double-throw
DPST	double-pole single-throw
elect	electrolytic
encap	encapsulated
F	farad(s)
FET	field effect transistor
fxd	fixed
GaAs	gallium arsenide
GHz	gigahertz = 10^{+9} hertz
gd	guard(ed)
Ge	germanium
gnd	ground(ed)
H	henry(ies)
Hg	mercury
Hz	hertz (cycle(s) per second)
ID	inside diameter
impg	impregnated
incd	incandescent
ins	insulation(ed)
kΩ	kilohm(s) = 10^{+3} ohms
kHz	kilohertz = 10^{+3} hertz
L	inductor
lin	linear taper
log	logarithmic taper
mA	milliampere(s) = 10^{-3} amperes
MHZ	megahertz = 10^{+6} hertz
MΩ	megohm(s) = 10^{+6} ohms
met flm	metal film
mfr	manufacturer
ms	millisecond
mtg	mounting
mV	millivolt(s) = 10^{-3} volts
μF	microfarad(s)
μs	microsecond(s)
μV	microvolt(s) = 10^{-6} volts
my	Mylar ®
nA	nanoampere(s) = 10^{-9} amperes
NC	normally closed
Ne	neon
NO	normally open
NPO	negative positive zero (zero temperature coefficient)
ns	nanosecond(s) = 10^{-9} seconds
nsr	not separately replaceable
Ω	ohm(s)
obd	order by description
OD	outside diameter
p	peak
pA	picoampere(s)
pc	printed circuit
pF	picofarad(s) 10^{-12} farads
piv	peak inverse voltage
p/o	part of
pos	position(s)
poly	polystyrene
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
prec	precision (temperature coefficient, long term stability and/or tolerance)
R	resistor
Rh	rhodium
rms	root-mean-square
rot	rotary
Se	selenium
sect	section(s)
Si	silicon
sl	slide
SPDT	single-pole double-throw
SPST	single-pole single-throw
Ta	tantalum
TC	temperature coefficient
TiO_2	titanium dioxide
tog	toggle
tol	tolerance
trim	trimmer
TSTR	transistor
V	volt(s)
vacw	alternating current working voltage
var	variable
vdcw	direct current working voltage
W	watt(s)
w/	with
wiv	working inverse voltage
w/o	without
ww	wirewound
*	optimum value selected at factory, average value shown (part may be omitted)
**	no standard type number assigned selected or special type

® Dupont de Nemours

DESIGNATORS

A	assembly
B	motor
BT	battery
C	capacitor
CR	diode or thyristor
DL	delay line
DS	lamp
E	misc electronic part
F	fuse
FL	filter
HR	heater
IC	integrated circuit
J	jack
K	relay
L	inductor
M	meter
MP	mechanical part
P	plug
Q	transistor
QCR	transistor-diode
R(p)	resistor(pack)
RT	thermistor
S	switch
T	transformer
TB	terminal board
TC	thermocouple
TP	test point
TS	terminal strip
U	microcircuit
V	vacuum tube, neon bulb, photocell, etc.
W	cable
X	socket
XDS	lampholder
XF	fuseholder
Y	crystal
Z	network

6-15. DISASSEMBLY/ASSEMBLY PROCEDURES

6-16. The following procedures explain how to remove and replace certain cabinet parts and printed circuit assemblies.

WARNING

To avoid personal injury, be certain that the line power and all external inputs are disconnected from the HP 3457A before proceeding with any disassembly procedures.

CAUTION

To prevent damage to the HP 3457A, observe static handling and clean handling techniques when disassembling.

6-17. Rear Terminal Assembly Removal

6-18. No prior disassembly of the instrument is required to remove the Rear Terminal Assembly. Remove the Rear Terminal Assembly as follows:

a. Remove the power cord and all external input connections from the HP 3457A.

b. Remove the two screws attaching the Terminal Assembly to the rear panel.

c. Remove the Terminal Assembly from the rear panel and disconnect the attached connector.

d. Replace the Terminal Assembly by reversing the order of steps a through c.

6-19. Optional Plug-In Assembly Removal

6-20. No prior disassembly of the instrument is required to remove the Optional Plug-In Assemblies. Remove the Optional Plug-In Assemblies as follows:

a. Remove the power cord and all external input connections from the HP 3457A.

b. Remove the two screws attaching the Terminal Block Assembly to the rear panel.

c. Remove the Terminal Block Assembly.

d. Lift the two white locking levers to release the locking mechanism.

e. Use the holes provided in the corners of the Plug-In Assembly shield to pull the assembly free of the instrument.

f. Squeeze the locking tabs of the attached connector together and disconnect the connector.

g. To replace the Plug-In Assembly, reverse the order of steps a through f.

6-21. Top Cover Removal

6-22. No prior disassembly of the instrument is required to remove the Top Cover. Remove the Top Cover as follows:

a. Remove the power cord and all external input connections from the HP 3457A.

b. Turn the unit upside down and loosen the six screws in the bottom cover. (These are captive screws. It is not necessary to remove them completely).

c. Return the unit to an upright position and remove the top cover.

d. To replace the top cover, reverse the order of steps a through c.

6-23. Display Assembly Removal

6-24. The Top Cover must be removed prior to removing the Display Assembly. Remove the Display Assembly as follows:

a. Remove the Top Cover as described in paragraph 6-21.

b. Disconnect the plug on the back of the Display Assembly.

CAUTION

The pins of the plug connected to the display assembly are quite fragile. Disconnect the plug by pulling on the ribbon cable rather than the plug itself.

c. Remove the two screws attaching the Display Assembly to the Front Panel.

d. Remove the Display Assembly from the Front Panel.

e. To replace the Display Assembly, reverse the order of steps a through d.

6-25. Digital (A1 or A11) Assembly Removal

6-26. It will be necessary to remove the Top Cover prior to removing the Digital Assembly. To remove the Digital Assembly:

a. Remove the Top Cover as described in paragraph 6-21.

b. Remove the four screws holding the shield to the Digital Assembly and remove the shield.

c. Remove the power switch pushrod. Grasp the pushrod firmly near the power switch and pull it off the power switch shaft.

d. Disconnect connectors P501 (Use the white pull strap), P502, P701 and P702 from the Digital Assembly.

e. Remove the two screws attaching the HPIB Connector/Heat Sink bracket to the rear panel.

f. Remove the Digital Assembly by raising the front edge of the board and sliding it forward.

g. To replace the Digital (A1) Assembly, reverse the order of steps a through f.

6-27. Plug-In Support Assembly Removal

6-28. The Rear Terminal Assembly or Plug-In Assembly and Top Cover must be removed prior to removing the Plug-In Support Assembly. Remove the Support Assembly as follows:

a. Remove the Rear Terminal Assembly (paragraph 6-17) or Plug-In Assembly (paragraph 6-19) and Top Cover (paragraph 6-21).

b. With the front panel of the instrument facing you, move the Plug-In Support Assembly slightly to the left to release the locking tab, and lift the support upward.

c. Lay the Plug-In Support Assembly over the front panel to gain access to the Top Analog Shield. (The Support Assembly will be supported by its cables.)

d. Remove the Top Analog Shield. (Press the sheet metal tabs near the center of the instrument to release the shield, lift the shield and remove it.)

e. Disconnect connector A2-P501 and the five input wires to remove the Support Assembly.

f. To replace the Plug-In Support Assembly, reverse the order of steps a through e.

6-29. AC Convertor (A3) Assembly Removal

6-30. It will be necessary to remove the Rear Terminal Assembly or Plug-In Assembly, Top Cover, and Plug-In Support Assembly prior to removing the AC Convertor Assembly.

a. Remove the Rear Terminal Assembly (paragraph 6-17) or Plug-In Assembly (paragraph 6-19), Top Cover (paragraph 6-21) and Plug-In Support Assembly (paragraph 6-27).

b. Disconnect the red and black input wires and connector A2-P303 from the Analog (A2) Assembly.

c. Remove the screw located near the center of the AC Convertor Assembly.

d. Remove the AC Convertor Assembly.

e. To replace the AC Convertor Assembly, reverse steps a through d.

6-31. Analog (A2) Assembly Removal

6-32. The Rear Terminal Assembly or Plug-In Assembly, Top Cover, Plug-In Support Assembly, and AC Convertor (A3) Assembly must be removed prior to removing the Analog (A2) Assembly. Remove the Analog Assembly as follows:

a. Remove the Rear Terminal Assembly (paragraph 6-17) or Plug-In Assembly (paragraph 6-19), Top Cover (paragraph 6-21), Plug-In Support Assembly (paragraph 6-27) and AC Convertor Assembly (paragraph 6-29).

b. Disconnect the five input wires from the front panel and connectors A1 or A11-P502 and A2-P901.

c. Remove the seven screws which hold the A2 Assembly to the bottom shield. (It is not necessary to remove the screws from the Reference Assembly.)

d. Slide the Analog Assembly toward the rear of the instrument to clear the fuse holder from the front panel and remove the assembly.

e. To replace the Analog Assembly, reverse steps a through d.

6-33. Front Panel Removal

6-34. It is necessary to remove the Rear Terminal Assembly or Plug-In Assembly, Top Cover, Plug-In Support Assembly, AC Convertor (A3) Assembly and Analog (A2) Assembly prior to removing the Front Panel Assembly. Remove the Front Panel Assembly as follows:

a. Remove the Rear Terminal Assembly (paragraph 6-17) or Plug-In Assembly (paragraph 6-19), Top Cover (paragraph 6-21), Plug-In Support Assembly (paragraph 6-27), AC Convertor (A3) Assembly (paragraph 6-29) and Analog (A2) Assembly (paragraph 6-31).

b. Disconnect connector P501 from the Digital Assembly.

c. Remove the screw attaching the Front Panel to the bottom shield of the Digital Assembly.

d. Lift the Front Panel clear of the bottom cover.

e. To replace the Front Panel Assembly, reverse the order of steps a through d.

Table 6-2. HP 3457A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
Δ_j A1	03457-66501	7	1	PC ASSY-MAIN CONTROLLER	28480	03457-66501
A1BT501	1420-0278	7	1	BATTERY 2.9V .72A-HR LI/S-DIOX W-FLEX	PWCON	B9511
A1C500	0160-4812	0	4	CAPACITOR-FXD 220PF +-5% 100VDC CER	56289	592CCOG221J100B
A1C501-C502	0160-4788	9	4	CAPACITOR-FXD 18PF +-5% 100VDC CER	56289	592CCOG180J100B
A1C503	0160-3335	0	2	CAPACITOR-FXD 470PF +-10% 100VDC CER	16299	CAC02X7R471K100A
A1C505	0160-4832	4	25	CAPACITOR-FXD .01UF +-10% 100VDC CER	56289	592CX7R103K100C
A1C506	0180-1746	5	4	CAPACITOR-FIXED 15UF +-10% 20VDC TA	56289	150D156X9020B2
A1C507	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	56289	592CX7R103K100C
A1C509	0160-4835	7	9	CAPACITOR-FIXED .1UF +-10% 50VDC CER	16299	CAC04X7R104K050A
A1C510	0180-1746	5		CAPACITOR-FIXED 15UF +-10% 20VDC TA	56289	150D156X9020B2
A1C511	0160-4835	7		CAPACITOR-FIXED .1UF +-10% 50VDC CER	16299	CAC04X7R104K050A
A1C512	0160-4805	1	2	CAPACITOR-FIXED 47PF +-5% 100VDC CER	24546	CAC02C0G470J100A
A1C513	0160-4835	7		CAPACITOR-FIXED .1UF +-10% 50VDC CER	16299	CAC04X7R104K050A
A1C514	0180-0291	3	22	CAPACITOR-FIXED 1UF +-10% 35VDC	56289	150D105X9035A2-DYS
A1C515	0160-4835	7		CAPACITOR-FIXED .1UF +-10% 50VDC CER	16299	CAC04X7R104K050A
A1C516	0160-4825	5	2	CAPACITOR-FXD 560PF +-5% 100VDC CER	56289	592CCOG561J100C
A1C517	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	56289	592CCOG221J100B
A1C550	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A1C552	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A1C553	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A1C572	0180-0309	4	3	CAPACITOR-FIXED 4.7UF +-20% 10VDC TA	56289	150D475X0010A2
A1C574	0160-4571	8	35	CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C575-C577	0160-3847	9	18	CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
A1C578	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C579	0160-3847	9		CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
A1C580	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C581-C582	0160-3847	9		CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
A1C583	0160-4835	7		CAPACITOR-FIXED .1UF +-10% 50VDC CER	16299	CAC04X7R104K050A
A1C584-C585	0160-3847	9		CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
A1C586	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C587	0160-3847	9		CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
A1C588-C589	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C590-C591	0160-3847	9		CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
A1C592-C593	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C594	0160-3847	9		CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
A1C595	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C596-C597	0160-3847	9		CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
A1C598-C599	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C701	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	56289	592CX7R103K100C
A1C702	0180-3446	6	1	CAPACITOR-FXD 3300UF+-20% 25VDC AL	UCMCN	SM25VB3300MMC
A1C703	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C704	0180-0374	3	2	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A1C705-C706	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	56289	592CX7R103K100C
A1CR501-504	1901-0050	3	49	DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A1CR505	1901-0518	8	5	DIODE-SMALL SIGNAL SCHOTTKY (A2X871)	71785	5082-2800

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1CR506-509	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A1CR511	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A1CR513-516	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A1CR517	1901-0518	8		DIODE-SMALL SIGNAL SCHOTTKY (A2X871)	71785	5082-2800
A1CR518	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A1CR701-702	1901-0743	1	11	DIODE-POWER RECTIFIER 400V 1A	14936	1N4004
A1CR703	1902-0936	6	3	DIODE-ZENER 6V +-5% PD=5W IR=300UA	9N171	TVS505
A1H701	03457-01201	8	2	BRACKET-HEAT SINK	28480	03457-01201
A1J501	1251-8601	7	2	CONN-POST TYPE .100-PIN-SPCG 34-CONT	76381	3594-6002
A1J502	1251-7760	7	2	CONN-POST TYPE .100-PIN-SPCG 4-CONT	00779	102202-1
A1J503	5180-8228	7	2	CONNECTOR-HPIB	28480	5180-8228
A1J701	1252-0239	3	2	CONN-POST TYPE 5.0-PIN-SPCG 8-CONT	27264	10-16-3081
A1J702	1252-0206	4	2	CONN-POST TYPE .100-PIN-SPCG 5-CONT	00779	640454-5
A1JM532	1251-5619	1	3	CONN-POST TYPE .100-PIN-SPCG 4-CONT	18873	65500-104
A1JM532A	1258-0141	8	6	JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	00779	530153-2
A1JM533	1251-4682	6	1	CONNECTOR-3 PIN MALE POST TYPE	27264	22-10-2031
A1JM533A	1258-0141	8		JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	00779	530153-2
A1L701-703	9100-1788	6	6	CORE-FERRITE WIDEBAND CHOKE IMP:>680	02114	VK200 20/4B
Δ_u **A1MP1**	**0370-0603**	1	1	**KEYCAP-POWER SWITCH**	**28480**	**0370-0603**
A1MP2	03457-43701	1	1	PUSHROD-POWER SWITCH	28480	03457-43701
A1Q500	1854-0296	8	1	TRANSISTOR NPN SI TO-92 PD=310MW	04713	MPS6543 SELECTED
A1Q501	1854-0215	1	4	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A1Q502-Q503	1853-0036	2	5	TRANSISTOR-PNP SI PD=310MW FT=250MHZ	27014	2N3906
A1Q504-Q505	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A1Q506	1853-0036	2		TRANSISTOR-PNP SI PD=310MW FT=250MHZ	27014	2N3906
A1R500	0698-3615	8	2	RESISTOR 47Ω 5% 2W MO TC=0+-200	27167	FP42-2-T00-47R0-J
A1R501	0686-1515	8	1	RESISTOR 150Ω 5% .5W CC TC=0+529	01121	EB1515
A1R502	0698-3359	7	2	RESISTOR 12.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1272-F
A1R504	0757-0449	6	9	RESISTOR-FXD 20K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2002-F
A1R506	0757-0445	2	2	RESISTOR-FXD 13K 1% 1/8W F TC=0+-10	24546	CT4-1/8-T0-1302-F
A1R507	0698-4482	9	4	RESISTOR-FXD 17.4K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1742-F
A1R508	0757-0449	6		RESISTOR-FXD 20K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2002-F
A1R509-R510	0757-0438	3	12	RESISTOR-FXD 5.11K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A1R513-R514	0757-0273	4	3	RESISTOR-FXD 3.01K 1% 1/8W F TC=+-100	24546	CT4-1/8-T0-3011-F
A1R515	0757-0280	3	19	RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R523	0757-0438	3		RESISTOR-FXD 5.11K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A1R525	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R527	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R530	0757-0465	6	13	RESISTOR-FXD 100K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A1R532	0698-6324	2	1	RESISTOR-FXD 187 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-187R-F
A1R540	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R545-R547	0757-0442	9	29	RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A1R549	0757-0346	2	3	RESISTOR-FXD 10Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A1R550	0757-0465	6		RESISTOR-FXD 100K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A1R552-R553	0757-0465	6		RESISTOR-FXD 100K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1003-F

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R554	0757-0446	3	9	RESISTOR-FXD 15K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1502-F
A1R555	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A1R556-R557	0757-0407	6	10	RESISTOR-FXD 200Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-201-F
A1R558-R559	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R560	0757-0458	7	6	RESISTOR-FXD 51.1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5112-F
A1R561-R562	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A1R563	0698-4482	9		RESISTOR-FXD 17.4K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1742-F
A1R564	0757-0438	3		RESISTOR-FXD 5.11K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A1R565	0757-0290	5	1	RESISTOR-FXD 6.19K 1% 1/8W F TC=0+-100	19701	5033R-1/8-T0-6191-F
A1R566	0757-0273	4		RESISTOR-FXD 3.01K 1% 1/8W F TC=+-100	24546	CT4-1/8-T0-3011-F
A1R567	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R568	0757-0438	3		RESISTOR-FXD 5.11K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A1R569	0757-0407	6		RESISTOR-FXD 200Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-201-F
A1RP503	1810-0560	7	2	NETWORK-RESISTOR 5.6K X 8 16-DIP	56289	916C562X1SR
A1RP516	1810-0286	4	5	NETWORK-RESISTOR 16-DIP 10KΩ X 15	56289	916C103X2PE
A1RP525	1810-0286	4		NETWORK-RESISTOR 16-DIP 10KΩ X 15	56289	916C103X2PE
A1RP533	1810-0124	9	2	NETWORK-RES 16-DIP 200.0Ω X 8	91637	MDP1603-201G
A1RP534	1810-0286	4		NETWORK-RESISTOR 16-DIP 10KΩ X 15	56289	916C103X2PE
A1RT500	0837-0220	1	2	THERMISTOR ROD 10KΩ TC=-3.83%/C-DEG	75263	AL1545-6240-73-S6
A1S701	3101-2252	7	4	SWITCH-PB DPDT ALTNG 4A 250VAC	71468	602094
A1S702-S703	3101-2769	1	2	SWITCH-SL DPDT ST 5A 250VAC PC	D8351	4021.4722
A1SP501	0960-0561	4	2	AUDIO TRANSDUCER 1-3VDC; 85DB AT 1.5V	STRMC	QMB-01-S.P.
A1U501	1820-2624	9	2	IC-MPU; CLK FREQ=2MHZ, ENHANCED 6800	04713	MC68B09P
$\Delta_{e,l}$ A1U502	03457-88805	0	1	IC-MEMORY	28480	03457-88805
A1U503	1818-3430	2	1	IC NMOS 65536 (64K) ROM 200-NS 3-S	S0562	TMM2365P(MASKED)
A1U504	1820-1872	7	2	IC BFR TTL LS INV OCTL 2-INP	27014	DM81LS96N
A1U505	1820-3662	7	2	IC-DC TO 4MHZ 6402 UART	34371	HD1-6402-B3409
A1U506	1818-1611	7	1	IC-STAT RAM 16384 (16K) CMOS 150NS 3S	34335	AM9128-15PC
A1U507	1820-2549	7	2	IC-GPIB TALKER/LISTENER	34649	P8291A(E-VERSION)
A1U508	1LH4-0001	4	2	IC-16 BIT GPIB TRANSCEIVER	28480	1LH4-0001
A1U509-U510	1820-2216	5	2	IC-OCTAL D-TYPE POS-EDGE-TRIG CMOS FF	27014	MM74C374N
A1U511	1818-3429	9	1	IC-STAT RAM 16384 (16K) CMOS 200NS 3S	S0562	TC5517APL-2(SEL)
A1U512-U513	1820-1216	3	2	IC-DCDR/DMUXR 3-TO-8-LINE 3-INP TTL LS	01295	SN74LS138N
A1U514	1820-3197	3	1	IC-BIN ASYNCHRO COUNTER CMOS/74HC	04713	MC74HC4020N
A1U515	1820-3208	7	1	IC-BIN ASYNCHRO COUNTER CMOS/74HC	27014	MM74HC393N
A1U516	1820-3173	5	2	IC-FF J-K NEG-EDGE-TRIG CMOS/74HC	04713	MC74HC112N
A1U517	1820-1872	7		IC BFR TTL LS INV OCTL 2-INP	27014	DM81LS96N
A1U519	1826-0138	8	4	IC-QUAD COMPARATOR GP 14-DIP-P PKG	27014	LM339N
A1U591	1820-2924	2	3	IC-QUAD 2-INPUT NOR GATE CMOS/74HC	04713	MC74HC02N
A1U592	1820-3173	5		IC-FF J-K NEG-EDGE-TRIG CMOS/74HC	04713	MC74HC112N
A1U593	1820-2922	0	3	IC-QUAD 2-INPUT NAND GATE CMOS/74HC	04713	MC74HC00N
A1U594	1820-3097	2	1	IC-QUAD 2-INPUT AND GATE CMOS/74HC	27014	MM74HC08N
A1U595	1820-2922	0		IC-QUAD 2-INPUT NAND GATE CMOS/74HC	04713	MC74HC00N
A1U596	1820-1203	8	1	IC-TRIPLE 3-INPUT POS-AND GATE TTL LS	01295	SN74LS11N

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1U597	1820-2924	2		IC-QUAD 2-INPUT NOR GATE CMOS/74HC	04713	MC74HC02N
A1U598	1820-2922	0		IC-QUAD 2-INPUT NAND GATE CMOS/74HC	04713	MC74HC00N
A1U599	1820-1199	1	1	IC-HEX INVERTER 1-INP TTL LS	01295	SN74LS04N
A1U701	1826-0551	9	3	IC-FXD V RGLTR POS 4.9/5.1V TO-220	27014	LM340AT-5
A1X502	1200-0861	8	2	SOCKET-IC 28-CONT DIP DIP-SLDR	00779	640362-1
Δ_o A1Y500	0410-1864	7	1	CRYSTAL-QUARTZ 7.980 MHZ	28480	0410-1864
A2	03457-66502	8	1	PC ASSY-ANALOG	28480	03457-66502
A2A1	03456-66525	4	1	REFERENCE ASSEMBLY (NATIONAL)	28480	03456-66525
Δ_m A2C101	0160-6842	0	3	CAPACITOR-FIXED 220PF +-10% 630VDC	28480	0160-6842
A2C111	0160-4804	0	1	CAPACITOR-FXD 56PF +-5% 100VDC CER	16299	CAC02COG560J100A
A2C112	0160-4532	1	4	CAPACITOR-FIXED 1000PF +-20% 50VDC CER	56289	592CX7R102M050B
A2C113	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C114	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C117	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C118	0180-0229	7	3	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A2C119	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A2C121	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A2C122	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C123	0160-4532	1		CAPACITOR-FIXED 1000PF +-20% 50VDC CER	56289	592CX7R102M050B
Δ_m A2C201-202	0160-6842	0		CAPACITOR-FIXED 220PF +-10% 630VDC	28480	0160-6842
A2C203	0160-6267	3	2	CAPACITOR-FXD 100PF +-5% 200VDC CER	04222	SA106A101JAA
Δ_q A2C204	0160-6840	8	2	CAPACITOR-FXD 150PF +-2% 630VDC POLYP-1	19701	703E1AD151P631AX
A2C211	0160-4532	1		CAPACITOR-FIXED 1000PF +-20% 50VDC CER	56289	592CX7R102M050B
A2C212	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C213	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C214	0160-5349	0	1	CAPACITOR-FXD 200PF +-5% 100VDC CER	56289	292C0G201J100B
A2C401	0160-4791	4	6	CAPACITOR-FXD 10PF +-5% 100VDC CER	04222	SA106A100JAA
A2C402	0160-6267	3		CAPACITOR-FXD 100PF +-5% 200VDC CER	04222	SA106A101JAA
A2C403	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C501	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C502	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C503	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C504	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C505	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C506	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
Δ_n A2C511	0160-6839	5	1	CAPACITOR-FXD 470PF +-2% 630VDC POLYP	19701	703E1AD471PG631AX
A2C512	0160-6208	2	1	CAPACITOR-FXD .1UF +-10% 50VDC	10214	ECR-7767K
A2C513-C515	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C514	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C515	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
Δ_q A2C516	0160-6840	8		CAPACITOR-FXD 150PF +-2% 630VDC POLYP-1	19701	703E1AD151P631AX
A2C517	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C521	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A2C522	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2C523	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A2C524	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A2C525	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A2C526	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER	04222	SA106A100JAA
A2C531	0160-3847	9		CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
Δ_i A2C532-533	0160-2343	8	2	CAPACITOR-FXD 100PF +-10% 200VDC CER	72982	8101-025-X5R0-101K
A2C901	0180-3447	7	1	CAPACITOR-FXD 1000UF+-20% 25VDC AL	UCMCN	SM25VB1000MMC
A2C902	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A2C910	0160-5755	2	1	CAPACITOR-FXD .1UF +-10% 100VDC CER	04222	SA401C104KAA
A2C911	0180-2986	7	2	CAPACITOR-FXD 330UF+-20% 50VDC AL	56289	513D337M050DG4W
A2C912	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A2C921	0180-2986	7		CAPACITOR-FXD 330UF+-20% 50VDC AL	56289	513D337M050DG4W
A2C922	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A2CR111-112	1901-0376	6	6	DIODE-GENERAL PURPOSE 35V 50MA	9N171	1N3595
A2CR113-114	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A2CR118	1902-0952	6	15	DIODE-ZNR 5.6V 5% PD=.4W TC=+.046%	04713	SZ30035-10RL
A2CR119	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A2CR121-134	1902-0952	6		DIODE-ZNR 5.6V 5% PD=.4W TC=+.046%	04713	SZ30035-10RL
A2CR135-137	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A2CR201	1901-0849	8	1	DIODE-POWER RECTIFIER 1KV 1A DO-41	14936	1N4007
A2CR202	1902-0962	8	1	DIODE-ZNR 15V 5% PD=.4W TC=+.087%	04713	SZ30035-020
A2CR401-404	1901-0838	5	4	DIODE-POWER RECTIFIER 200V 1.5A	30043	1N5393
A2CR511-514	1901-0040	1	4	DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2CR531	1902-0958	2	2	DIODE-ZNR 10V 5% PD=.4W TC=+.075%	04713	SZ30035-16RL
A2CR532	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A2CR901-902	1901-0743	1		DIODE-POWER RECTIFIER 400V 1A	14936	1N4004
A2CR903	1902-0936	6		DIODE-ZENER 6V +-5% PD=5W IR=300UA	9N171	TVS505
A2CR904	1901-0743	1		DIODE-POWER RECTIFIER 400V 1A	14936	1N4004
A2CR911-912	1901-0743	1		DIODE-POWER RECTIFIER 400V 1A	14936	1N4004
A2CR913	1902-1000	7	2	DIODE-ZNR 39V 5% PD=5W IR=500NA	04713	1N5366B
A2CR914	1902-0632	9	2	DIODE-ZNR 17V 5% PD=5W TC=+75%	04713	1N5354B
A2CR921-922	1901-0743	1		DIODE-POWER RECTIFIER 400V 1A	14936	1N4004
A2CR923	1902-1000	7		DIODE-ZNR 39V 5% PD=5W IR=500NA	04713	1N5366B
A2CR924	1902-0632	9		DIODE-ZNR 17V 5% PD=5W TC=+75%	04713	1N5354B
A2E101	1970-0100	9	1	TUBE-ELECTRON SURGE VOLTAGE PROTECTOR	JSLYN	2031-55-B1
A2E401	1970-0052	0	2	TUBE-ELECTRON SURGE VOLTAGE PROTECTOR	25088	B1-C90/20
A2F101	2110-0043	8	2	FUSE 1.5A 250V NTD 1.25X.25 UL	75915	312 01.5
A2H911	1205-0318	0	1	HEAT SINK SGL TO-220-CS	13103	6045B
A2H921	1205-0355	5	1	HEAT SINK SGL TO-220-CS	13103	6043PB
A2J101-J110	1251-0600	0	12	CONNECTR-SGL CONT PIN 1.14MM-BSC-SZ SQ	83486	928-196-004140
A2J301-J302	1251-0600	0		CONNECTR-SGL CONT PIN 1.14MM-BSC-SZ SQ	83486	928-196-004140
A2J303	1251-8106	7	2	CONN-POST TYPE 20-CONT .100-PIN-SPCG	76381	3592-6002
A2J501	1251-8106	7		CONN-POST TYPE 20-CONT .100-PIN-SPCG	76381	3592-6002
A2J502	1251-6515	8	1	CONNECTOR-POST-TYPE 6 PIN MALE	22526	65610-106
A2J503	1251-6064	2	1	CONNECTOR-POST TYPE 5 PIN MALE	27264	22-10-2052

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2J504	1251-6191	6	1	CONNECTOR-POST TYPE 4 PIN MALE	27264	22-11-2053
A1J901	1252-0206	4		CONN-POST TYPE .100-PIN-SPCG 5-CONT	00779	640454-5
Δ_p A2K101	0490-1606	3	2	RELAY-4A 5VDC-COIL 4A 250VAC	AROMT	S4EB-L2-5V-H35
A2K102	0490-1337	7	2	RELAY-4A 5VDC-COIL 4A 250VAC	AROMT	S4EB-L2-5V-H24
Δ_p A2K103	0490-1606	3		RELAY-4A 5VDC-COIL 4A 250VAC	AROMT	S4EB-L2-5V-H35
A2K104	0490-1337	7		RELAY-4A 5VDC-COIL 4A 250VAC	AROMT	S4EB-L2-5V-H24
Δ_f A2K106	0490-1556	2	1	RELAY-REED 2A 5VDC-COIL 250MA 400VDC	71707	3500-0050
Δ_g A2K107	0490-1555	1	4	RELAY-REED 2A 5VDC-COIL 250MA 400VDC	71707	3500-0051
Δ_g A2K201	0490-1555	1		RELAY-REED 2A 5VDC-COIL 250MA 400VDC	71707	3500-0051
Δ_g A2K301-302	0490-1555	1		RELAY-REED 2A 5VDC-COIL 250MA 400VDC	71707	3500-0051
A2K401-K403	0490-1450	5	3	RELAY 2C 5VDC-COIL 2A 250VAC	AROMT	DS2E-SL2-DC5V-C-H83
A2L201	9100-1666	9	1	INDUCTOR RF-CH-MLD 3.6MH 5% .23DX.57LG	24226	22M364J
A2L401	9140-0478	3	1	INDCTR RF-CH-MLD 1UH 10% .164DX.45LG	83125	WEE-1.0
Δ_a A2L501	7157-0057	7	1	RESISTOR-ZERO OHMS SOLID TINNED COPPER	28480	7157-0057
A2Q111	1855-0246	0	2	TRANSISTOR-JFET DUAL N-CHAN D-MODE	27014	SF83075
A2Q112	1855-0247	1	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE	27014	SF83080
A2Q113	1853-0086	2	1	TRANSISTOR PNP SI PD=310MW FT=40MHZ	27014	2N5087
A2Q114	1854-0392	5	1	TRANSISTOR NPN SI PD=310MW FT=50MHZ	04713	2N5088
A2Q118	1855-0567	8	2	TRANSISTOR-MOSFET P-CHANNEL E-MODE SI	9M011	IRFD9123
A2Q119	1855-0550	9	&	TRANSISTOR-MOSFET P-CHANNEL E-MODE SI	17856	VP0300L
A2Q121	1855-0567	8		TRANSISTOR-MOSFET P-CHANNEL E-MODE SI	9M011	IRFD9123
A2Q211	1855-0425	7	2	TRANSISTOR-JFET N-CHANNEL D-MODE TO-92	27014	J304
A2Q212	1855-0305	2	2	TRANSISTOR-JFET N-CHANNEL D-MODE	17856	2N4117A
A2Q213-Q216	1853-0510	7	4	TRANSISTOR-PNP SILICON (2N6520 SELECT)	04713	SPS8342
A2Q217	1855-0305	2		TRANSISTOR-JFET N-CHANNEL D-MODE	17856	2N4117A
A2Q501	1853-0036	2		TRANSISTOR-PNP SI PD=310MW FT=250MHZ	27014	2N3906
A2Q511	1855-0410	0	2	TRANSISTOR-JFET N-CHANNEL D-MODE SI	17856	FN2761
A2Q512	1855-0425	7		TRANSISTOR-JFET N-CHANNEL D-MODE TO-92	27014	J304
A2Q513	1855-0243	7	1	TRANSISTOR-JFET DUAL N-CHANNEL SI	27014	SF94009
A2Q514	1855-0246	0		TRANSISTOR-JFET DUAL N-CHAN D-MODE	27014	SF83075
A2Q515	1855-0410	0		TRANSISTOR-JFET N-CHANNEL D-MODE SI	17856	FN2761
A2Q522	1853-0036	2		TRANSISTOR-PNP SI PD=310MW FT=250MHZ	27014	2N3906
A2R101-R102	0686-5135	6	6	RESISTOR 51K 5% .5W CC TC=0+765	01121	EB5135
A2R103	0698-8777	3	6	RESISTOR-FXD 1K 5% 1/4W CC TC=-400+900	01121	CB1025
A2R104	0683-1055	5	5	RESISTOR-FXD 1M 5% 1/4W FC TC=-800+900	19701	(CR-25) 1-4-5P-1M
A2R111-R112	0699-0642	7	2	RESISTOR-FXD 10K .1% .1W F TC=0+-5	19701	5023za10k00b
A2R113	2100-3383	4	1	RESISTOR-TRMR 50Ω 10% C TOP-ADJ 1-TRN	01121	E2A500
A2R114	0757-0438	3		RESISTOR-FXD 5.11K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A2R115	0757-0449	6		RESISTOR-FXD 20K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2002-F
A2R116-R117	0757-0465	6		RESISTOR-FXD 100K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A2R118	0757-0453	2	4	RESISTOR-FXD 30.1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-3012-F
A2R119	0683-1055	5		RESISTOR-FXD 1M 5% 1/4W FC TC=-800+900	19701	(CR-25) 1-4-5P-1M
A2R121	0757-0401	0	5	RESISTOR-FXD 100Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-101-F
Δ_c A2R122	0757-0284	7	2	RESISTOR-FXD 150Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-151-F

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R123	0757-0283	6	3	RESISTOR-FXD 2K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A2R201-R204	0686-5135	6		RESISTOR 51K 5% .5W CC TC=0+765	01121	EB5135
A2R205	0757-0435	0	1	RESISTOR-FXD 3.92K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-3921-F
A2R206	8159-0005	0	6	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	11502	ZEROHM
A2R211	0699-1125	3	1	RESISTOR-FXD 40K .1% .6W F TC=0+-4.2	18612	301031
A2R212	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R213-R214	0757-0474	7	2	RESISTOR-FXD 243K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2433-F
A2R215	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R216-R217	0683-5145	2	2	RESISTOR-FXD 510K 5% 1/4W FC	19701	(CR-25) 1-4-5P-510K
A2R218	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R221	0698-7652	1	1	RESISTOR-FXD 49.9K 1% 1/8W F TC=0;-25	19701	MF4C1/8-T9-4992-F
Δ_d A2R219	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R222-R223	0698-7082	1	2	RESISTOR-FXD 100K 1% 1/8W F TC=0+-25	28480	0698-7082
A2R301	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A2R302	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A2R401	0699-1514	4	&	RESISTOR-FXD .1Ω 1% 5W F TC=0+-50	01686	LO-5-.1-1-RP
A2R402	0811-3709	3	1	RESISTOR-FXD 1Ω 1% 3W PW TC=0+-50	91637	RS2B-227
A2R403	0699-1627	0	1	RESISTOR-FXD 9Ω .1% 1/8W F TC=0+-10	28480	0699-1627
A2R404	0699-1628	1	1	RESISTOR-FXD 90Ω .1% 1/8W F TC=0+-10	28480	0699-1628
A2R405	0699-1629	2	2	RESISTOR-FXD 900Ω .1% 1/8W F TC=0+-10	28480	0699-1629
A2R408	0699-1065	0	1	RESISTOR-FXD 10K 5% 1/4W CC TC=-400+700	01121	CB1035
A2R500	0698-8737	5	1	RESISTOR 100K 5% 1/4W CC TC=-400/+800	01121	CB1045
A2R501	0698-4406	7	4	RESISTOR-FXD 115Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-115R-F
A2R502	0757-0438	3		RESISTOR-FXD 5.11K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A2R503	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R504	0757-0401	0		RESISTOR-FXD 100Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R504A-R504B	9170-0894	0	2	CORE-SHIELDING BEAD	02114	56-590-65/4A6
Δ_k A2R505	0757-0472	5	3	RESISTOR-FXD 200K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2003-F
A2R506	0698-8777	3		RESISTOR-FXD 1K 5% 1/4W CC TC=-400+900	01121	CB1025
A2R507	0757-0394	0	2	RESISTOR-FXD 51.1Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A2R508	0698-4406	7		RESISTOR-FXD 115Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-115R-F
A2R511	0698-4411	4	1	RESISTOR-FXD 140Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-140R-F
A2R513	0757-0438	3		RESISTOR-FXD 5.11K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A2R514	0757-0401	0		RESISTOR-FXD 100Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R515	0757-0465	6		RESISTOR-FXD 100K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A2R516	0757-0274	5	1	RESISTOR-FXD 1.21K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A2R517-R518	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R519	0757-0464	5	1	RESISTOR-FXD 90.9K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-9092-F
A2R520	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R521	0757-0449	6		RESISTOR-FXD 20K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2002-F
A2R523	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R524	0757-0465	6		RESISTOR-FXD 100K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A2R526	0757-0458	7		RESISTOR-FXD 51.1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5112-F
A2R527	0757-0283	6		RESISTOR-FXD 2K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A2R528-R529	0757-0458	7		RESISTOR-FXD 51.1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5112-F

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R531	0757-0410	1	2	RESISTOR-FXD 301Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-301R-F
A2R532	0757-0438	3		RESISTOR-FXD 5.11K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A2R533	0757-0394	0		RESISTOR-FXD 51.1Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A2R534	0757-0433	8	1	RESISTOR-FXD 3.32K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-3321-F
A2R535	0757-0458	7		RESISTOR-FXD 51.1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5112-F
A2R536	0757-0283	6		RESISTOR-FXD 2K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A2R537	0757-0410	1		RESISTOR-FXD 301Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-301R-F
A2R538	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	11502	ZEROHM
A2R541	0757-0453	2		RESISTOR-FXD 30.1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-3012-F
A2R542	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R543	0757-0461	2	2	RESISTOR-FXD 68.1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-6812-F
A2R544	0757-0465	6		RESISTOR-FXD 100K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A2R545	0757-0461	2		RESISTOR-FXD 68.1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-6812-F
A2R546	0757-0438	3		RESISTOR-FXD 5.11K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A2R547	0757-0278	9	1	RESISTOR-FXD 1.78K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1781-F
A2R548	0757-0401	0		RESISTOR-FXD 100Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R551	0757-0346	2		RESISTOR-FXD 10Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A2R910	0757-0420	3	1	RESISTOR-FXD 750Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-751-F
A2RV101	0837-0320	2	1	VOLTAGE SUPPRESSOR VMAC=230V VMDC=300V	SEMNS	S07K230
A2U101	1QH5-0085	6	1	IC-DC INPUT HYBRID	28480	1QH5-0085
A2U111	1826-0521	3	4	IC-DUAL LOW-BIAS-H-IMPD OP AMP	01295	TL072CP
A2U112	1826-0346	0	3	IC-DUAL GEN-PURPOSE OP AMP 8-DIP-P PKG	27014	LM358N
A2U121	1820-3861	8	1	IC-SYCHRONOUS SERIAL-IN SHIFT REGISTER	15818	TSC9404CJ
A2U122-U123	1820-1662	3	5	IC-SHFT RGTR SERIAL-IN 8-BIT PARA OUT	04713	MC14094BCP
Δ_b A2U211-212	1826-1381	5	2	IC LOW-BIAS HIGH IMPD OP AMP	LINER	LT1012CN8
A2U213	1813-0437	3	1	IC-PRECISION OP AMP 8-TO-99 PKG	8E175	OPA111BM
A2U214	1826-1205	2	5	IC-ANALOG SWITCH 2 SPDT 16-DIP-P PKG	34371	HI3-0390-5
A2U216	1858-0054	4	2	IC-TRANSISTOR ARRAY (CA3096E) 16-DIP-P	3L585	90974
A2U217	1826-0861	4	2	IC-10 BIT D/A CONVERTOR 16-DIP-P PKG	24355	AD7533LN
A2U218	1826-0346	0		IC-DUAL GEN-PURPOSE OP AMP 8-DIP-P PKG	27014	LM358N
A2U401	1826-0521	3		IC-DUAL LOW-BIAS-H-IMPD OP AMP	01295	TL072CP
A2U402-U403	1826-1205	2		IC-ANALOG SWITCH 2 SPDT 16-DIP-P PKG	34371	HI3-0390-5
A2U501	1820-3549	9	1	IC-SINGLE-CHIP 8-BIT MICROCOMPUTER	34335	P8051 MASKED
A2U502	1820-3174	6	1	IC SCHMITT-TRIG CMOS/74HC NAND QUAD	04713	MC74HC132N
Δ_a A2U502A	1200-1207	8	1	ACCESSORY-SOCKET FERRITE SLAB	34899	2643373941
A2U503	1820-3081	4	1	IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG	04713	MC74HC74N
A2U504	1813-0449	7	1	CLOCK-OSCILLATOR-XTAL 12.0-MHZ 0.01%	04713	RASCO-1C-SP89-12.0000MH
A2U505-U506	1820-2925	3	2	IC-SYNCHRONOUS BINARY COUNTER CMOS/74HC	04713	MC74HC161N
A2U507	1820-3672	9	1	IC 4-TO-1-LINE MUXR/DATA SEL CMOS/74HC	04713	MC74HC253N
A2U508	1820-2924	2		IC-QUAD 2-INPUT NOR GATE CMOS/74HC	04713	MC74HC02N
A2U509-U510	1990-1075	1	2	IC-LED OPTO-ISOLATOR GATE IF=20MA-MAX	OPTEK	KT3172
A2U511	1QF6-0066	3	1	IC-KEY A/D HYBRID	28480	1QF6-0066
A2U512-U513	1826-1265	4	2	IC-WIDEBAND OP-AMP (LT318AN8 SELECTED)	LINER	SL30028
A2U514	1826-0346	0		IC-DUAL GEN-PURPOSE OP AMP 8-DIP-P PKG	27014	LM358N
A2U515	1826-0138	8		IC-QUAD COMPARATOR GP 14-DIP-P PKG	27014	LM339N

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
Δ_a A2U516	1826-1382	6	1	IC PRECISION OP AMP 8-DIP-P PKG	LINER	LT1001CN8(SELECTED)
A2U517	1826-0521	3		IC-DUAL LOW-BIAS-H-IMPD OP AMP	01295	TL072CP
A2U901	1826-0551	9		IC-FXD V RGLTR POS 4.9/5.1V TO-220	27014	LM340AT-5
A2U901H	1205-0592	2	1	HEAT SINK 25.4MM WD 41.91MM LG 35.4MM	13103	16908B-1
A2U911	1826-0396	0	1	IC-FIXED VOLTAGE RGLTR POS 14.4/15.6V	27014	LM340T-15
A2U921	1826-0214	1	1	IC-FIXED VOLTAGE RGLTR NEG 14.4/15.6V	04713	MC7915CT
A2W501	8120-4576	7	1	CABLE ASSEMBLY-FLAT RIBBON 4-CONDUCTOR	00779	487295-1
A2XF101	2110-0642	3	1	FUSEHOLDER-EXTERNAL POST 6.3A 250V	28480	2110-0642
A2XF101A	2110-0565	9	2	FUSEHOLDER CAP 12A MAX FOR UL RECOG	PNLCC	031.1666
A3	03457-66503	9	1	PC ASSY-AC	28480	03457-66503
A3C301	0160-5386	5	1	CAPACITOR-FIXED .15UF +-10% 630VDC	19701	701B1LH154PK631SX
A3C302	0160-2005	9	1	CAPACITOR-FXD 230PF +-1% 500VDC MICA	KAGAN	HP15231F5C1
A3C303-C304	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER	04222	SA106A100JAA
A3C305	0160-6251	5	1	CAPACITOR-FIXED 20PF +-2% 500VDC CER	96733	R3619-12
A3C306	0160-4803	9	1	CAPACITOR-FXD 68PF +-5% 100VDC CER	16299	CAC02COG680J100A
A3C307	0160-6249	1	1	CAPACITOR-FIXED 2400PF +-1% 50VDC CER	96733	R3619-13
A3C308	0160-4814	2	1	CAPACITOR-FIXED 150PF +-5% 100VDC CER	16299	CAC02COG151J100A
A3C310	0160-4789	0	1	CAPACITOR-FIXED 15PF +-5% 100VDC CER	28480	0160-4789
A3C312	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A3C313	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A3C314	0160-4532	1		CAPACITOR-FIXED 1000PF +-20% 50VDC CER	56289	592CX7R102M050B
A3C315	0160-4793	6	1	CAPACITOR-FXD 6.8PF +-.5PF 100VDC CER	16299	CAC02COG6R8D100A
A3C316	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A3C318	0160-2453	1	1	CAPACITOR-FXD .22UF +-10% 80VDC POLYE	19701	708D1MV224PK800AX
A3C319	0160-6207	1	3	CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	ELECN	ECR7766J
A3C320	0160-6395	8	1	CAPACITOR-FXD .22UF +-5% 50VDC	ELECN	ECR7763K
A3C321	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER	16299	CAC02COG101J100A
A3C322	0160-4811	9	1	CAPACITOR-FXD 270PF +-5% 100VDC CER	16299	CAC02COG271J100A
A3C323	0160-6394	7	1	CAPACITOR-FXD .022UF 75VDC	ELECN	ECR7764K
A3C324	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER	04222	SA106A100JAA
A3C325	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A3C326	0160-3847	9		CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
A3C327	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A3C328	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A3C329	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A3C330	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A3C332	0121-0560	5	1	CAPACITOR-V AIR DIEL .8-5PF 500V PC-MTG	18736	V3246
A3C333-C334	0160-6207	1		CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	ELECN	ECR7766J
A3C335	0160-0576	5	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	04222	SR205C104MAA
A3C336	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER	04222	SA106A100JAA
A3C337	0180-0291	3		CAPACITOR-FIXED 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A3C340	0160-3847	9		CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
A3C341	0160-3847	9		CAPACITOR-FIXED .01UF +100 -0% 50VDC	16299	CAC02X7R103X050A
A3CR301-304	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A3CR305-CR308	1901-0376	6		DIODE-GENERAL PURPOSE 35V 50MA	9N171	1N3595

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3CR309	1902-3054	5	2	DIODE-ZENER 3.65V 5% DO-35 PD=.4W	04713	SZ30016-056
A3CR310-CR311	1902-0943	5	3	DIODE-ZNR 2.4V 5% DO-35 PD=.4W	04713	SZ30035-001
A3CR312	1902-3054	5		DIODE-ZENER 3.65V 5% DO-35 PD=.4W	04713	SZ30016-056
A3CR313-318	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A3CR319	1901-0518	8		DIODE-SMALL SIGNAL SCHOTTKY (A2X871)	71785	5082-2800
A3CR320-322	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A3CR323	1902-0943	5		DIODE-ZNR 2.4V 5% DO-35 PD=.4W	04713	SZ30035-001
A3CR324-325	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A3CR326	1901-0518	8		DIODE-SMALL SIGNAL SCHOTTKY (A2X871)	71785	5082-2800
A3JM301	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	11502	ZEROHM
A3JM303-304	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	11502	ZEROHM
A3K301-K302	0490-1336	6	2	RELAY- 5VDC-COIL 4A 250VAC	AROMT	S2EB-L2-5V-H22
A3MP1	03457-00610	1	1	SHIELD-AC	28480	03457-00610
A3MP2	0403-0294	0	4	SPACER-SNAP-IN .500 IN LONG .280 IN OD	06915	PS-8R
A3Q301-Q306	1855-0611	3	6	TRANSISTOR-J-FET N-CHAN TO92 SI	17856	J-2741
A3Q307	1855-0301	8	1	TRANSISTOR-DUAL J-FET N-CHAN SI	27014	2N5198
A3Q308	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A3Q309	1855-0406	4	1	TRANSISTOR-J-FET P-CHAN D-MODE SI	17856	J6040
A3R302-R303	0698-8706	8	2	RESISTOR 50K .1% .5W F TC=0+-25	28480	0698-8706
A3R304	0699-1568	8	1	RESISTOR-FXD 900K .1% 1/4W F TC=0+-10	28480	0699-1568
A3R305	0699-1569	9	1	RESISTOR-FXD 991K .1% 1/4W F TC=0+-10	28480	0699-1569
A3R306	0757-0446	3		RESISTOR-FXD 15K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1502-F
A3R307	0699-1635	0	1	RESISTOR-FXD 8.1K .1% 1/10W F TC=0+-10	28480	0699-1635
A3R308	0699-1629	2		RESISTOR-FXD 900Ω .1% 1/8W F TC=0+-10	28480	0699-1629
A3R309	0757-0401	0		RESISTOR-FXD 100Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-101-F
A3R310-R311	0698-8777	3		RESISTOR-FXD 1K 5% 1/4W CC TC=-400+900	01121	CB1025
A3R312-R313	0698-3279	0	4	RESISTOR-FXD 4.99K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-4991-F
A3R314	0698-8777	3		RESISTOR-FXD 1K 5% 1/4W CC TC=-400+900	01121	CB1025
A3R315-R318	0757-0446	3		RESISTOR-FXD 15K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1502-F
A3R319	0698-6343	5	1	RESISTOR-FXD 9K .1% 1/8W F TC=0+-25	28480	0698-6343
A3R320	0698-6362	8	2	RESISTOR-FXD 1K .1% 1/8W F TC=0+-25	28480	0698-6362
A3R321	0683-1055	5		RESISTOR-FXD 1M 5% 1/4W FC TC=-800+900	19701	(CR-25) 1-4-5P-1M
A3R322	0698-8777	3		RESISTOR-FXD 1K 5% 1/4W CC TC=-400+900	01121	CB1025
A3R323	0683-1055	5		RESISTOR-FXD 1M 5% 1/4W FC TC=-800+900	19701	(CR-25) 1-4-5P-1M
A3R324	0683-3055	9	1	RESISTOR 3M 5% .25W FC TC=-900/+1100	01121	CB3055
A3R325-R326	0757-0463	4	2	RESISTOR-FXD 82.5K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-8252-F
A3R327	0698-3228	9	3	RESISTOR-FXD 49.9K 1% 1/8W F TC=0+-100	28480	0698-3228
A3R328-R329	0699-1619	0	1	RESISTOR-MATCHED SET 1.8K & 200Ω	28480	0699-1619
A3R330-R331	0757-0407	6		RESISTOR-FXD 200Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-201-F
A3R332	0699-0467	4	1	RESISTOR-FXD 1.8K .1% 1/10W F TC=0+-10	28480	0699-0467
A3R333	0699-0082	9	1	RESISTOR-FXD 215Ω .1% 1/10W F TC=0+-10	28480	0699-0082
A3R334	0699-0154	6	1	RESISTOR-FXD 7.2K .1% 1/8W F TC=0+-25	28480	0699-0154
A3R335	0698-3497	4	1	RESISTOR-FXD 6.04K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-604R-F
A3R336	0757-0407	6		RESISTOR-FXD 200Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-201-F
A3R337	0757-0472	5		RESISTOR-FXD 200K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2003-F

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3R338	0698-6362	8		RESISTOR-FXD 1K .1% 1/8W F TC=0+-25	28480	0698-6362
A3R339-R340	0698-3279	0		RESISTOR-FXD 4.99K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-4991-F
A3R341-R342	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A3R343	0757-0472	5		RESISTOR-FXD 200K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2003-F
A3R345	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A3R346	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A3R347	0757-0449	6		RESISTOR-FXD 20K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2002-F
A3R348	0757-0422	5	1	RESISTOR-FXD 909Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-909R-F
A3R349	0757-0467	8	1	RESISTOR-FXD 121K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1213-F
A3R350	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A3R351	0757-0284	7	1	RESISTOR-FXD 150Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-151-F
A3R352	0757-0449	6		RESISTOR-FXD 20K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2002-F
A3R353	0757-0468	9	2	RESISTOR-FXD 130K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1303-F
A3R354	0757-0453	2		RESISTOR-FXD 30.1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-3012-F
A3R355	0757-0449	6		RESISTOR-FXD 20K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2002-F
A3R356	0698-3447	4	1	RESISTOR-FXD 422Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A3R357	0683-1055	5		RESISTOR-FXD 1M 5% 1/4W FC TC=-800+900	19701	(CR-25) 1-4-5P-1M
A3R358-R361	0683-5135	0	4	RESISTOR-FXD 51K 5% 1/4W FC TC=-400+800	19701	(CR-25) 1-4-5P-51K
A3R362	0698-4500	2	1	RESISTOR-FXD 57.6K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5762-F
A3R363	0698-3228	9		RESISTOR-FXD 49.9K 1% 1/8W F TC=0+-100	28480	0698-3228
A3R364	0757-0440	7	1	RESISTOR-FXD 7.5K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A3R365	0698-3228	9		RESISTOR-FXD 49.9K 1% 1/8W F TC=0+-100	28480	0698-3228
A3R366	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A3R367	0757-0453	2		RESISTOR-FXD 30.1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-3012-F
A3R368	0757-0468	9		RESISTOR-FXD 130K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1303-F
A3R369-R370	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A3R371	0757-0446	3		RESISTOR-FXD 15K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1502-F
A3R372	0757-0446	3		RESISTOR-FXD 15K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1502-F
A3R373-R374	0698-6286	5	2	RESISTOR 100M 10% 1/4W FC TC=-900+1200	01121	CB1071
A3RP301	1810-0232	0	1	NETWORK-RESISTOR 100.0K X 6 8-SIP	56289	216CH104X9PM
A3U301	1826-0521	3		IC-DUAL LOW-BIAS-H-IMPD OP AMP	01295	TL072CP
A3U302	1826-1309	7	2	IC-WIDE-BAND OP AMP 14-DIP-P PKG	34371	HA3-2625-5 SELECTED
A3U303	1826-1205	2		IC-ANALOG SWITCH 2 SPDT 16-DIP-P PKG	34371	HI3-0390-5
A3U304	1826-1309	7		IC-WIDE-BAND OP AMP 14-DIP-P PKG	34371	HA3-2625-5 SELECTED
A3U305	1826-1301	9	1	IC-RMS-AC TO DC CONVERTOR 14-CERDIP	24355	AD637KD (SELECTED)
A3U306	1826-1205	2		IC-ANALOG SWITCH 2 SPDT 16-DIP-P PKG	34371	HI3-0390-5
A3U307	1826-0962	6	1	IC-DUAL LOW-BIAS-H-IMPD OP AMP 8-DIP-P	27014	LF412CN
A3U308	1826-0493	8	1	IC-LOW-BIAS-HI-IMPD OP AMP 8-DIP-P PKG	27014	LM308AN
A3U309	1826-0412	1	2	IC-DUAL PRECISION COMPARATOR 8-DIP-P	27014	LM393N
A3U310	1826-0065	0	1	IC-PRECISION COMPARATOR 8-DIP-P PKG	01295	LM311P
A3U311	1826-0861	4		IC-10 BIT D/A CONVERTOR 16-DIP-P PKG	24355	AD7533LN
A3U312	1826-0138	8		IC-QUAD COMPARATOR GP 14-DIP-P PKG	27014	LM339N
A3U313	1826-0412	1		IC-DUAL PRECISION COMPARATOR 8-DIP-P	27014	LM393N
A3U314-U316	1820-1662	3		IC-SHFT RGTR SERIAL-IN 8-BIT PARA OUT	04713	MC14094BCP
A3U317	1855-0591	8	1	TRANSISTOR ARRAY 14-PIN PLSTC DIP	17856	VQ1000J
A3U318	1826-0994	4	1	IC-V RGLTR-ADJ-NEG 1.2/37V TO-92 PKG	27014	LM337LZ

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3W303	03457-61602	9	1	CBL ASSY-AC BD	28480	03457-61602
A4	03457-60201	2	1	ASSY-FRONT PANEL	28480	03457-60201
A4FL1	9170-1183	2	2	CORE-TOROID AL=75-NH/TT	02114	846T250-4C4
A4W1	03457-61604	1	1	CBL ASSY-FRONT	28480	03457-61604
A4W1A	0362-0265	7	6	CONNECTOR-SGL CONT SKT 1.14-MM-BSC-SZ	27264	02-05-5204
A5	03457-67901	3	1	ASSY-BINDING POST REAR INPUT	28480	03457-67901
A5A1	03457-26506	8	1	PC BD-REAR INPUT TERMINALS	28480	03457-26506
A5A1E891	1970-0052	0		TUBE-ELECTRON SURGE VOLTAGE PROTECTOR	25088	B1-C90/20
A5A1F891	2110-0043	8		FUSE 1.5A 250V NTD 1.25X.25 UL	75915	312 01.5
A5A1J893	1252-0274	6	1	CONN-UTIL QIKMT 6-CKT 6-CONT	09922	SMZ6PH-4028
A5A1XF891	2110-0643	4	1	FUSEHOLDER-CLIP TYPE 15A 250 V	28480	2110-0643
Δ_j A11	03457-66511	9	1	PC ASSY-MAIN CONTROLLER	28240	03457-66511
Δ_t A11BT601	1420-0298	1	1	BATTERY 3.4V LI	28480	1420-0298
A11C601-C604	0160-4832	4		CAPACITOR-FIXED .01UF +-10% 100VDC	56289	592CX7R103K100C
A11C605-C606	0160-4788	9		CAPACITOR-FXD 18PF +-5% 100VDC CER	56289	592CCOG180J100B
A11C607	0160-4832	4		CAPACITOR-FIXED .01UF +-10% 100VDC	56289	592CX7R103K100C
A11C611-C613	0160-4832	4		CAPACITOR-FIXED .01UF +-10% 100VDC	56289	592CX7R103K100C
A11C614	0160-3335	0		CAPACITOR-FIXED 470PF +-10% 100VDC	16299	CAC02X7R471K100A
A11C617	0160-4835	7		CAPACITOR-FIXED .1UF +-10% 50VDC CER	16299	CAC04X7R104K050A
A11C618	0160-4832	4		CAPACITOR-FIXED .01UF +-10% 100VDC	56289	592CX7R103K100C
A11C621-C626	0160-4832	4		CAPACITOR-FIXED .01UF +-10% 100VDC	56289	592CX7R103K100C
A11C627	0160-4805	1		CAPACITOR-FIXED 47PF +-5% 100VDC CER	24546	CAC02C0G470J100A
A11C628-C629	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	56289	592CCOG221J100B
A11C631-C632	0160-4832	4		CAPACITOR-FIXED .01UF +-10% 100VDC	56289	592CX7R103K100C
A11C633	0180-0291	3		CAPACITOR-FXD 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A11C634-C635	0180-1746	5		CAPACITOR-FXD 15UF +-10% 20VDC TA	56289	150D156X9020B2
A11C636	0160-4835	7		CAPACITOR-FIXED .1UF +-10% 50VDC CER	16299	CAC04X7R104K050A
A11C637	0180-0309	4		CAPACITOR-FXD 4.7UF +-20% 10VDC TA	56289	150D475X0010A2
A11C638	0160-4835	7		CAPACITOR-FIXED .1UF +-10% 50VDC CER	16299	CAC04X7R104K050A
A11C639	0160-4825	5		CAPACITOR-FXD 560PF +-5% 100VDC CER	56289	592CCOG561J100C
A11C641	0160-4835	7		CAPACITOR-FIXED .1UF +-10% 50VDC CER	16299	CAC04X7R104K050A
A11C642	0180-0309	4		CAPACITOR-FXD 4.7UF +-20% 10VDC TA	56289	150D475X0010A2
A11C643-C644	0180-0291	3		CAPACITOR-FXD 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A11C701	0160-4832	4		CAPACITOR-FIXED .01UF +-10% 100VDC	56289	592CX7R103K100C
A11C702	0180-3879	9	1	CAPACITOR-FXD 3300UF+-20% 25VDC AL	UCMCN	SMC25VB332M18X43MC-V
A11C703	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	16299	CAC02Z5U104Z
A11C704	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A11C705-C706	0160-4832	4		CAPACITOR-FIXED .01UF +-10% 100VDC	56289	592CX7R103K100C
A11CR611-612	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A11CR621-625	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A11CR626	1902-0950	4	1	DIODE-ZNR 4.7V 5% PD=.4W TC=+.025%	04713	SZ30035-008
A11CR627	1902-0958	2		DIODE-ZNR 10V 5% PD=.4W TC=+.075%	04713	SZ30035-16RL
A11CR631-635	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A11CR636	1901-0518	8		DIODE-SMALL SIGNAL SCHOTTKY (A2X871)	71785	5082-2800
A11CR701-702	1901-0743	1		DIODE-POWER RECTIFIER 400V 1A DO-41	14936	1N4004
A11CR703	1902-0936	6		DIODE-ZENER 6V +-5% PD=5W IR=300UA	9N171	TVS505

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11H701	03457-01201	8	1	BRACKET-HEAT SINK	28240	03457-01201
A11J611	5180-8228	7		CONNECTOR-HPIB	28480	5180-8228
A11J612	1251-8601	7		CONN-POST TYPE .100-PIN-SPCG 34-CONT	76381	3594-6002
A11J613	1251-7760	7		CONN-POST TYPE .100-PIN-SPCG 4-CONT	00779	102202-1
A11J614	1251-5619	1		CONN-POST TYPE .100-PIN-SPCG 4-CONT	18873	65500-104
A11J701	1252-0239	3		CONN-POST TYPE 5.0-PIN-SPCG 8-CONT	27264	10-16-3081
A11J702	1252-0206	4	1	CONN-POST TYPE .100-PIN-SPCG 5-CONT	00779	640454-5
A11JM601-602	1251-7960	9	3	CONN-POST TYPE .100-PIN-SPCG 3-CONT	52072	CA-S03SP100-230-430X
A11JM601A	1258-0141	8		JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	00779	530153-2
A11JM602A	1258-0141	8		JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	00779	530153-2
A11JM621	1251-5619	1		CONN-POST TYPE .100-PIN-SPCG 4-CONT	18873	65500-104
A11JM621A	1258-0141	8		JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	00779	530153-2
A11JM633	1251-7960	9		CONN-POST TYPE .100-PIN-SPCG 3-CONT	52072	CA-S03SP100-230-430X
A11JM633A	1258-0141	8		JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	00779	530153-2
A11JM701	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	11502	ZEROHM
A11L701	9100-1788	6		CORE-FERRITE WIDEBAND CHOKE IMP:>680	02114	VK200 20/4B
A11L703	9100-1788	6		CORE-FERRITE WIDEBAND CHOKE IMP:>680	02114	VK200 20/4B
A11Q601	1853-0563	0	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	04713	SPS3612RLRA
A11R601-R602	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A11R603	0757-0438	3		RESISTOR-FXD 5.11K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A11R611-R612	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A11R613-R614	0698-4406	7		RESISTOR-FXD 115Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-115R-F
A11R615	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A11R616	0698-3359	7		RESISTOR-FXD 12.7K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1272-F
A11R617	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R618	0757-0458	7		RESISTOR-FXD 51.1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5112-F
A11R619	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R621	0757-0449	6		RESISTOR-FXD 20K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2002-F
A11R622	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A11R623	0757-0438	3		RESISTOR-FXD 5.11K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A11R624	0698-4482	9		RESISTOR-FXD 17.4K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1742-F
A11R625	0698-3615	8		RESISTOR 47Ω 5% 2W MO TC=0+-200	27167	FP42-2-T00-47R0-J
A11R626	0757-0346	2		RESISTOR-FXD 10Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A11R627	0757-0407	6		RESISTOR-FXD 200Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-201-F
A11R628	0757-0398	4	1	RESISTOR-FXD 75Ω 1% 1/8W F TC=0+-100	28480	0757-0398
A11R629	0757-0465	6		RESISTOR-FXD 100K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A11R631	0757-0465	6		RESISTOR-FXD 100K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A11R632-R633	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R634	0757-0465	6		RESISTOR-FXD 100K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A11R635	0757-0449	6		RESISTOR-FXD 20K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2002-F
A11R636-R637	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R638	0757-0446	3		RESISTOR-FXD 15K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1502-F
A11R639	0757-0407	6		RESISTOR-FXD 200Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-201-F
A11R641	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R642	0757-0465	6		RESISTOR-FXD 100K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1003-F

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11R643	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
Δ_t A11R644	0757-0445	2	1	RESISTOR-FXD 13K 1% 1/8 W F TC=0+-100	91637	CMF-55-1,T-1
Δ_t A11R645	0698-3359	7	2	RESISTOR-FXD 12.7K 1% 1/8 W F TC=0+-100	91637	CMF-55-1,T-1
A11R646	0757-0280	3		RESISTOR-FXD 1K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A11R647	0757-0407	6		RESISTOR-FXD 200Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-201-F
A11R648	0757-0442	9		RESISTOR-FXD 10K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R649	0757-0407	6		RESISTOR-FXD 200Ω 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-201-F
A11RP601	1810-0286	4		NETWORK-RESISTOR 16-DIP 10KΩ X 15	56289	916C103X2PE
A11RP602	1810-0307	0	2	NETWORK-CNDCT MODULE DIP 16 PIN 0.100	01121	316X101
A11RP611	1810-0307	0		NETWORK-CNDCT MODULE DIP 16 PIN 0.100	01121	316X101
A11RP612	1810-0124	9		NETWORK-RES 16-DIP 200.0Ω X 8	91637	MDP1603-201G
A11RP613	1810-0286	4		NETWORK-RESISTOR 16-DIP 10KΩ X 15	56289	916C103X2PE
A11RP614	1810-0560	7		NETWORK-RESISTOR 5.6K X 8 16-DIP	56289	916C562X1SR
A11RT611	0837-0220	1		THERMISTOR ROD 10KΩ TC=-3.83%/C-DEG	75263	AL1545-6240-73-S6
A11S701-S703	3101-2252	7		SWITCH-PB DPDT ALTNG 4A 250VAC	71468	602094
A11SP631	0960-0561	4		AUDIO TRANSDUCER 1-3VDC; 85DB AT 1.5V	STRMC	QMB-01-S.P.
A11U601	1820-2624	9		IC-MPU; CLK FREQ=2MHZ, ENHANCED 6800	04713	MC68B09P
A11U602	03457-88810	7	1	EPROM PROGRAMMED	28480	03457-88810
A11X602	1200-0861	8		SOCKET-IC 28-CONT DIP DIP-SLDR	00779	640362-1
A11U603	1818-3760	1	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	S0562	TC5564PL-15
A11U604-U605	1820-3847	0	2	IC-3-LINE TO 8-LINE DECODER/DEMUX	27014	MM74HCT138N
A11U606	1820-4946	2	1	IC-TRIPLE 3-INPUT NOR-GATE CMOS/74HC	18324	74HCT27N
A11U607	1820-3629	6	2	IC-HEX INVERTER CMOS/74HC	27014	MM74HCT04N
A11U608	1820-4945	1	1	IC-DUAL 4-INPUT NAND-GATE CMOS/74HC	28480	1820-4945
A11U611-U612	1820-3848	1	2	IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG	27014	MM74HCT374N
A11U613	1820-1794	2	1	IC-NON-INVERTING OCTAL BUFFER TTL LS	27014	DM81LS95N
A11U614	1820-2549	7		IC-GPIB TALKER/LISTENER	34649	P8291A(E-VERSION)
A11U615	1LH4-0001	4		IC-16 BIT GPIB TRANSCEIVER	28480	1LH4-0001
A11U616	1820-3662	7	1	IC-DC TO 4MHZ 6402 UART	34371	HD1-6402-B3409
A11U621	1820-3664	9	3	IC-QUAD 2-INPUT POS-NAND GATE CMOS/74HC	18324	74HCT00N
A11U622	1820-4583	3	1	IC-QUAD 2-INPUT AND GATE CMOS/74HC	18324	74HCT08N
A11U623	1820-3664	9		IC-QUAD 2-INPUT POS-NAND GATE CMOS/74HC	18324	74HCT00N
A11U624	1820-4721	1	1	IC-QUAD 2-INPUT OR-GATE CMOS/74HC	18324	74HCT32N
A11U625	1820-4643	6	1	IC-QUAD 2-INPUT NOR-GATE CMOS/74HC	18324	74HCT02N
A11U626	1820-4947	3	2	IC FLIP-FLOP J-K NEG-EDGE-TRIG PRESET	27014	MM74HCT112N
A11U631	1820-4949	5	1	IC ASYNCHRO BINARY CNTR NEG-EDGE	18324	74HCT020N
A11U632	1820-4948	4	1	IC ASYNCHRO BINARY CNTR NEG-EDGE	18324	74HCT393N
A11U633	1820-3664	9		IC-QUAD 2-INPUT POS-NAND GATE CMOS/74HC	18324	74HCT00N
A11U634	1820-3629	6		IC-HEX INVERTER CMOS/74HC	27014	MM74HCT04N
A11U635	1820-4947	3		IC FLIP-FLOP J-K NEG-EDGE-TRIG PRESET	27014	MM74HCT112N
A11U636	1826-0138	8		IC-QUAD COMPARATOR GP 14-DIP-P PKG	27014	LM339N
A11U637	1858-0054	4		IC-TRANSISTOR ARRAY (CA3096E) 16-DIP-P	3L585	90974
A11U701	1826-0551	9		IC-FXD V RGLTR POS 4.9/5.1V TO-220	27014	LM340AT-5

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-2. HP 3457A Replaceable Parts (cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11XRP602	1200-0853	8	2	SOCKET-IC 16-CONT DIP DIP-SLDR	00779	2-640358-1
A11XRP611	1200-0853	8		SOCKET-IC 16-CONT DIP DIP-SLDR	00779	2-640358-1
A11Y601	0410-1864	7	1	CRYSTAL-QUARTZ 7.980 MHz	28480	0410-1864
F601E	2110-0235	0	1	FUSE .2A 250V TD 1.25X.25 UL	75915	313.200
F601M	2110-0719	5	1	FUSE .08A 250V TD IEC	75915	218.080
FL601	9135-0167	6	1	FLTR-LINE CEE-22-TERMS	28480	9135-0167
J601-J602	1250-0083	1	2	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	24931	28JR130-1
J603	1510-0038	8	1	BINDING POST ASSY SGL THD-STUD	74970	111-2223-001
MP1	5040-5196	6	1	TOP SHELL	28480	5040-5196
MP2	5040-5195	5	1	SHELL-BOTTOM	28480	5040-5195
MP3	5040-7201	8	1	FOOT	28480	5040-7201
MP4	1460-1345	5	1	TILT STAND SST	28480	1460-1345
MP5	5040-7222	3	1	FOOT-NON SKID	28480	5040-7222
MP6	03457-00612	3	1	0601 SHLD-DGTL, B	28480	03457-00612
MP7	03457-00604	3	1	0601 SHLD-ANLG	28480	03457-00604
MP8	03457-44701	3	1	INSUL-SUPPORT	28480	03457-44701
MP9	5040-5297	8	1	SPACER	28480	5040-5297
MP10	1600-1185	9	1	FASTENER-RACK MOUNT	28480	1600-1185
MP11	5180-0223	6	1	SD TRIM CLAM SHL	28480	5180-0223
MP12	03457-00611	2	1	0503 SHLD-DGTL	28480	03457-00611
MP13	03457-00603	2	1	0503 SHLD-ANLG	28480	03457-00603
MP14	03457-00605	4	1	0601 GDE-SCNR	28480	03457-00605
MP15	03457-41201	2	1	GUIDE-PC BD	28480	03457-41201
MP18	03457-00201	6	1	0601 REAR PANEL	28480	03457-00201
T601	9100-4445	8	1	XFMR-POWER	28480	9100-4445
T601P701A	1252-0178	9	1	CONN-POST TYPE 8-CONTACT	27264	10-17-3081
T601P701B	1251-3073	7	1	CONTACT-CONN U/W-POST-TYPE FEM CRP	27264	08-50-0107
T601P701C	1251-4823	7	1	CONNECTOR-SGL CONT QDISC-FEM	00779	2-520183-2
T601P702	1252-0113	2	2	CONN-POST TYPE .100-PIN-SPCG 5-CONT	00779	640441-5
T601P901	1252-0113	2		CONN-POST TYPE .100-PIN-SPCG 5-CONT	00779	640441-5
W1	8120-1378	1	1	POWER CORD SET 18-AWG 3-COND 90-IN-LG	16428	CH7081
W2	03457-61605	2	1	CBL ASSY-REAR	28480	03457-61605
W2A	0362-0265	7		CONNECTOR-SGL CONT SKT 1.14-MM-BSC-SZ	27264	02-05-5204
W2L	9170-1183	2		CORE-TOROID AL=75-NH/TT	02114	846T250-4C4
W2P	1252-0275	7	1	CONN-UTIL QIKMT 6-CKT	09922	SMS6P3
W2P1A	1252-0798	9	5	CONTACT-CONN U/W-UTIL FEM CRP	09922	SC20M-1S6
W3	8120-4208	2	1	FLAT RIBBON ASSY 28-AWG 34-COND	28480	8120-4208
W4	03457-61603	0	1	CBL ASSY-SCANNER	28480	03457-61603
XF601	2110-0564	8	1	FUSEHOLDER BODY 12A MAX FOR UL RECOG	PNLCC	031.1657
XF601A	2110-0565	9		FUSEHOLDER CAP 12A MAX FOR UL RECOG	PNLCC	031.1666
XF601B	2110-0567	1	1	FUSEHOLDER CAP 12A MAX FOR UL RECOG	PNLCC	031.1663
XF601C	2110-0569	3	1	FUSEHOLDER COMPONENT NUT; THREAD M12.7	PNLCC	098.0043

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-3. HP 44491 Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	44491A	3	1	GENERAL PURPOSE 8-CHANNEL MULTIPLEXER	28480	44491A
A1	44491-66501	5	1	PC ASSY-GENERAL PURPOSE MULTIPLEXER	28480	44491-66501
A1C801	0160-4571	8	4	CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C804-C806	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C807	0180-0291	3	3	CAPACITOR-FXD 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A1C812-C813	0180-0291	3		CAPACITOR-FXD 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
Δ_r A1C814	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
Δ_r A1C815	0180-0309	4	1	CAPACITOR-FXD 4.7UF +-20% 10VDC TA	56289	150D475X0010A2
A1CR801-CR828	1901-0050	3	28	DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
A1F801-F802	2110-0043	8	2	FUSE 1.5A 250V NTD 1.25X.25 UL	75915	312 01.5
A1K800-K803	0490-1337	7	8	RELAY-4A 5VDC-COIL 4A 250VAC	AROMT	S4EB-L2-5V-H24
A1K804-K805	0490-1336	6	2	RELAY- 5VDC-COIL 4A 250VAC	AROMT	S2EB-L2-5V-H22
A1K806-K809	0490-1337	7		RELAY-4A 5VDC-COIL 4A 250VAC	AROMT	S4EB-L2-5V-H24
A1MP8	0403-0464	6	2	EXTR-PC BD WHT NYL .062-IN-BD-THKNS	32559	LP-06 WHITE
A1MP9	1480-0625	4	2	PIN-GRV .0938-IN-DIA .25-IN-LG SST	73597	GP5-094X0250-5
A1P801	5180-6696	9	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROWS	28480	5180-6696
A1P802	5180-6638	9	1	CONN-2X11 RT CLN	28480	5180-6638
A1P803	1252-0273	5	1	CONN-UTIL QIKMT 6-CKT 6-CONT	09922	SMS6PH-3D28
A1R801-R807	0683-2025	1	7	RESISTOR 2K 5% 1/4W FC TC=-400/+700	19701	(CR25) 1-4-5P-2K
Δ_r A1R808	0757-0283	6	1	RESISTOR-FXD 2K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A1R813	0698-8827	4	1	RESISTOR 1M 1% 1/8W F TC=0+-100	28480	0698-8827
A1SCW1	0515-0843	2	1	SCREW-MACH M2.5 X 0.45 20MM-LG	83486	ORDER BY DESCRIPTION
A1SHD1	03457-00608	7	1	SHIELD-SCANNER BOTTOM	28480	03457-00608
A1SHD1MP1	03488-84103	0	1	INSULATOR-ACCESSORY	28480	03488-84103
A1SHD1MP2	0590-1515	5	4	SPACER-PRESS-IN 14.5MM	28480	0590-1515
A1SHD2	03457-00609	8	1	SHIELD-SCANNER TOP	28480	03457-00609
A1U801-U802	1820-1662	3	2	IC-SHFT RGTR SERIAL-IN 8-BIT PARA OUT	04713	MC14094BCP
A1U803-U804	1858-0076	0	2	TRANSISTOR ARRAY 14-PIN PLSTC TO-116	04713	MPQ2907P
A1U805	1858-0047	5	1	TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A1U806-U807	1820-1486	9	2	IC QUAD 2-INPUT AND-GATE CMOS	3L585	CD4081BE
Δ_r A1U808	1826-1338	2	1	IC-SUPPLY VOLTAGE SUPERVISOR	01295	TL7705A
A1XF801	2110-0642	3	2	FUSEHOLDER-EXTERNAL POST 6.3A 250V	28480	2110-0642
A1XF801A	2110-0565	9	2	FUSEHOLDER CAP 12A MAX FOR UL RECOG	PNLCC	031.1666
A1XF802	2110-0642	3		FUSEHOLDER-EXTERNAL POST 6.3A 250V	28480	2110-0642
A1XF802A	2110-0565	9		FUSEHOLDER CAP 12A MAX FOR UL RECOG	PNLCC	031.1666
J1	44491-62101	3	1	CONN-TERM BLOCK	28480	44491-62101
J93	5040-5193	3	1	HOUSING-CONNECTOR	28480	5040-5193
J93HDW1-2	2190-0584	0	2	WASHER-LOCK HLCL 3.0MM SCREW (3.1MM-ID)	28480	ORDER BY DESCRIPTION
J93HDW3-4	3050-0891	7	2	WASHER-FLAT MTLC 3.0MM SCREW (3.3MM-ID)	28480	ORDER BY DESCRIPTION
J93MP1	5040-5194	4	1	CABLE CLAMP	28480	5040-5194
J93SCW1-4	5180-8269	6	4	SCREW-CAPTIVE	28480	5180-8269

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

Table 6-4. HP 44492 Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	44492A	4	1	MULTIPLEXER 10-CHANNEL	28480	44492A
A1	44492-66501	6	1	PC ASSY-REED RELAY MULTIPLEXER	28480	44492-66501
A1C851-852	0160-4571	8	5	CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C853	0180-0291	3	3	CAPACITOR-FXD 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
A1C854-C856	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
A1C857-C858	0180-0291	3		CAPACITOR-FXD 1UF +-10% 35VDC TA	56289	150D105X9035A2-DYS
Δ_s A1C859	0160-4571	8		CAPACITOR-FIXED .1UF +80 -20% 50VDC	16299	CAC02Z5U104Z
Δ_s A1C860	0180-0309	4	1	CAPACITOR-FXD 4.7UF +-20% 10VDC TA	56289	150D475X0010A2
A1CR851-860	1902-0965	1	10	DIODE-ZNR 20V 5% DO-35 PD=.4W TC=+.09%	04713	SZ30035-023
A1CR861	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO35	9N171	1N4150
Δ_h A1K851-860	0490-1576	6	10	RLY-REED 3A 250MA 184VAC 5VDC-COIL 5VA	71707	3400-0089
A1L851-L852	9100-3560	6	2	INDUCTOR RF-CH-MLD 5.6UH 5% .166 X .385	24226	15M561J
A1MP8	0403-0464	6	2	EXTR-PC BD WHT NYL .062-IN-BD-THKNS	32559	LP-06 WHITE
A1MP9	1480-0625	4	2	PIN-GRV .0938-IN-DIA .25-IN-LG SST	73597	GP5-094X0250-5
A1P851	5180-6696	9	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROWS	28480	5180-6696
A1P852	5180-6639	0	1	CONN 2X11 RT CLN	28480	5180-6639
A1P853	1252-0273	5	1	CONN-UTIL QIKMT 6-CKT 6-CONT	09922	SMS6PH-3D28
A1R851-R860	0683-2025	1	10	RESISTOR 2K 5% 1/4W FC TC=-400/+700	19701	(CR25) 1-4-5P-2K
A1R861-R862	0698-8768	2	2	RESISTOR 100Ω 5% 1/4W CC TC=-400/+500	01121	CB1015
A1R864	0698-8827	4	1	RESISTOR 1M 1% 1/8W F TC=0+-100	28480	0698-8827
Δ_s A1R865	0757-0283	6	1	RESISTOR-FXD 2K 1% 1/8W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A1SCW1	0515-0843	2	1	SCREW-MACH M2.5 X 0.45 20MM-LG	83486	ORDER BY DESCRIPTION
A1SHD1	03457-00608	7	1	SHIELD-SCANNER BOTTOM	28480	03457-00608
A1SHD1MP1	03488-84103	0	1	INSULATOR-ACCESSORY	28480	03488-84103
A1SHD1MP2	0590-1515	5	4	SPACER-PRESS-IN 14.5MM	28480	0590-1515
A1SHD2	03457-00609	8	1	SHIELD-SCANNER TOP	28480	03457-00609
A1U851-U852	1820-1662	3	2	IC-SHFT RGTR SERIAL-IN 8-BIT PARA OUT	04713	MC14094BCP
A1U853-U855	1858-0076	0	3	TRANSISTOR ARRAY 14-PIN PLSTC TO-116	04713	MPQ2907P
Δ_s A1U856	1826-1338	2	1	IC-SUPPLY VOLTAGE SUPERVISOR	01295	TL7705A
J1	44492-62101	4	1	CONN-TERM BLOCK	28480	44492-62101
J93	5040-5193	3	1	HOUSING-CONNECTOR	28480	5040-5193
J93HDW1-2	2190-0584	0	2	WASHER-LOCK HLCL 3.0MM SCREW (3.1MM-ID)	28480	ORDER BY DESCRIPTION
J93HDW3-4	3050-0891	7	2	WASHER-FLAT MTLC 3.0MM SCREW (3.3MM-ID)	28480	ORDER BY DESCRIPTION
J93MP1	5040-5194	4	1	CABLE CLAMP	28480	5040-5194
J93SCW1-4	5180-8269	6	4	SCREW-CAPTIVE	28480	5180-8269

A delta (Δ) preceeding a part number indicates that a change has been made to that part. See Table 6-5 for an explanation of the change.

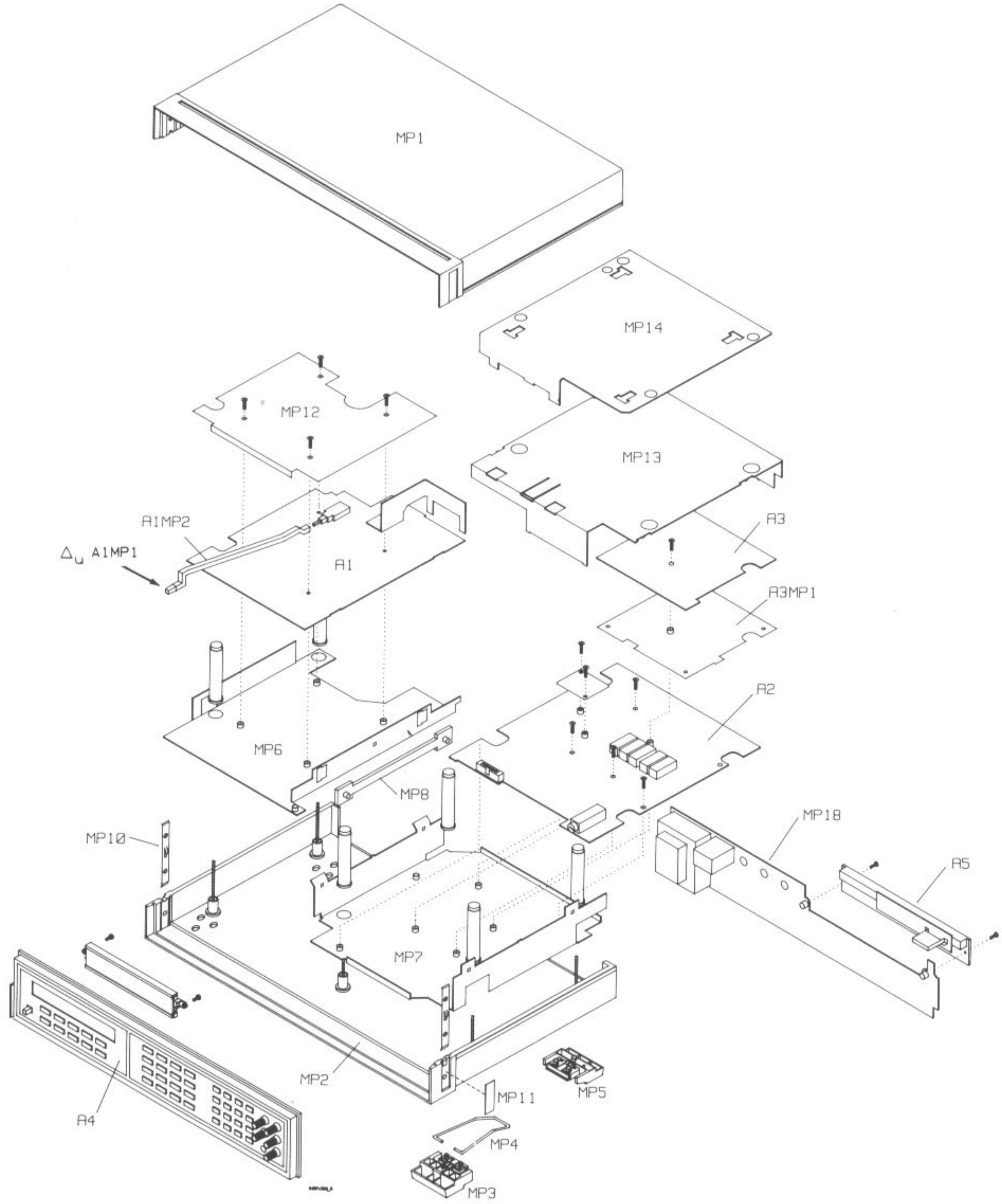

MP1
MP14
MP12
MP13
A1MP2
Δ_U A1MP1
A1
A3
A3MP1
A2
MP6
MP8
MP18
A5
MP10
MP7
MP2
A4
MP11
MP5
MP4
MP3

Figure 6-1. Exploded View

Table 6-5. List of Part Changes

Δ_a Operational Amplifier A2U516, part no. 1826-0635 (OP-07CP), has been replaced with part no. 1826-1382 to achieve better initial time drift of VOS to guarantee 90 day/1 year specifications. Ferrite Slab A2U502A (part no. 1200-1207) has been added to eliminate RFI generated by A2U502. Inductor A2L501, part no. 9100-1788, has been replaced by a jumper wire (A2JM503) to reduce power supply noise generated by Processor A2U501. These improvements have been implemented on A2 Assemblies which have an ERC (Engineering Revision Code) of **2521** or greater.

Δ_b Operational Amplifiers A2U211 and A2U212, part no. 1826-1133 (LM11CH) have been replaced, in all applications, with part no. 1826-1381 to reduce noise and improve offset drift. The new part will be found on A2 Assemblies which have an ERC of **2524** or greater.

Δ_c Resistor A2R122, part no. 0757-0410 (301Ω) has been replaced, in all applications, with part no 0757-0284 (150Ω) to eliminate a parasitic oscillation which causes an excessive input current in A2U101. The new part will be found on A2 Assemblies which have an ERC of **2529** or greater.

Δ_d Resistor A2R219, part no. 0757-0442 (10KΩ) has been added to provide extra operating margin for A2U214. This part will be found on A2 Assemblies which have an ERC of **2551** or greater. Printed circuit board becomes Revision B.

Δ_e EPROM A1U502, part no. 03457-88803, has been replaced by part no. 03457-88804 to correct a "trigger too fast" error when external trigger was executed from program memory. This part will be found on A1 Assemblies which have an ERC of **2609** or greater.

Δ_f Relay A2K106, part no. 5180-8233 has been replaced, in all applications, with part no. 0490-1556. This change was made to standardize part useage with a higher quality part.

Δ_g Relays A2K107, A2K201, A2K301 and A2K302, part no. 5180-8234 has been replaced, in all applications, with part no. 0490-1555. This change was made to provide a higher quality part and standardize part useage.

Δ_h Relays A1K851 through A1K860, part no. 0490-1461, have been replaced, in all applications, with part no. 0490-1576 to standardize relay usage and reduce cost. These parts will be found on HP 44492 PC Assemblies which have an ERC of **2644** or greater.

Δ_i Capacitors A2C532 and A2C533, part no. 0160-2343 (100pf) have been added to A2 Assemblies to reduce the common mode signal present at A2J501. These parts will be found on A2 Assemblies which have an ERC of **2703** or greater. Printed circuit board becomes Revision C.

Δ_j The A1 Main Controller Assembly (part no. 03457-66501) has been replaced with the A11 Main Controller Assembly (part no. 03457-66511). This change was made to add Option 700 (CIIL language). The A11 assembly is a direct replacement for the A1 assembly.

Δ_k Resistor A2R505, part no. 0757-0465 (100KΩ) has been replaced, in all applications, with part no. 0757-0472 (200KΩ) to insure that the microprocessor (A2U501) always starts with a reset signal at turn-on. The new part will be found on A2 Assemblies with an ERC of **2708** and greater.

Δ_l EPROM A1U502 (part no. 03457-88804) has been replaced, in all applications, by part no. 03457-88805 to correct a timing error of the "voltmeter complete" signal when using the 4-Wire Ohms function and to eliminate the possibilty of shorting two input channels when a "device clear" signal is received while the instrument is executing a scan list.

Table 6-5. List of Part Changes (cont'd)

Δ_m Capacitors A2C101, A2C201 and A2C202, part no. 0160-4479 (220pf) have been replaced with part no. 0160-6842 (220pf) for compatibilty with the HP 3457 production process. Both parts are electrically identical. The new part will be found on A2 Assemblies which have an ERC of **2712** or greater.

Δ_n Capacitor A2C511, part no. 0160-4438 (470pf) has been replaced by part no. 0160-6839 (470pf) for compatibility with the HP 3457 production process. This part will be found on A2 Assemblies which have an ERC of **2712** or greater.

Δ_o Crystal A1Y500, part no. 0410-1553 (8.000 MHz), has been replaced, in all applications, with part no. 0410-1864 (7.980 MHz) to reduce RFI caused by harmonics of the inguard oscillator and the outguard oscillator adding.

Δ_p Relays A2K101 and A2K103, part number 0490-1337, have been replaced with part number 0490-1606 in all applications to ensure contact resistance stability. The new parts will be found on A2 Assemblies which have an ERC of **2710** or greater.

Δ_q Capacitors A2C204 and A2C516, part no. 0160-4461 (150pf), have been replaced with part no. 0160-6840, in all applications, for compatibility with the HP 3457 production process. The new parts will be found on A2 Assemblies which have an ERC of **2721** or greater.

Δ_r Capacitors A2C814 (.1uF), A2C815 (4.7uF), resistor A2R808 (2k), and A2U808 have been added to the A1 Assembly to eliminate the possibility of two channels being closed when the power switch is switched to OFF. The A1 Printed Circuit Board becomes Revision B.

Δ_s Capacitors A2C859 (.1uF), A2C860 (4.7uF), resistor A2R865 (2k), and A2U856 have been added to the A1 Assembly to eliminate the possibility of two channels being closed when the power switch is switched to OFF. The A1 Printed Circuit Board becomes Revision B.

Δ_t Battery A11BT601 (2.9V), part no. 1420-0278, and resistors A11R644, part no. 0698-4482, and A11R645, part no. 0757-0445, are replaced by Battery A11BT601 (3.4V), part no. 1420-0298 and resistors A11R644, part no. 0757-0445, and A11R645, part no. 0698-3359, for compatibility with the HP 3457 production process. The new battery is not compatible with the old resistor network. The new parts are on assembly A11, ERC no. 2850 and greater.

Δ_u Keycap and pushrod found on A1, A1MP1 and A1MP2, are not supplied when replacing an A1 assembly with an A11 assembly. Retain both keycap and pushrod when exchanging an A1 for an A11 assembly.

Table 6-6. Code List of Manufacturers

Mfr Code	Manufacturer's Name	Address	Zip Code
00779	AMP INC	HARRISBURG PA	17111
01121	ALLEN-BRADLEY CO. INC.	EL PASO TX	79935
01295	TEXAS INSTRUMENTS INC. SEMICONDUCTOR COMPONENT DIVISION	DALLAS TX	75222
01686	RCL ELECTRONICS INCORPORATED	MANCHESTER NH	03102
02114	FERROXCUBE CORPORATION	SAUGERTIES NY	12477
04222	AVX CERAMICS CORPORATION	MYRTLE BEACH SC	29577
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX AZ	85008
06915	RICHCO PLASTIC COMPANY	CHICAGO IL	60646
09922	BURNDY CORPORATION	NORWALK CT	06856
11502	TRW INCORPORATED BOONE DIVISION	BOONE NC	28607
13103	THERMALLOY COMPANY	DALLAS TX	75234
13606	SPRAGUE ELECTRIC COMPANY SEMICONDUCTOR DIVISION	CONCORD NH	03301
14936	GENERAL INSTRUMENT SEMICONDUCTOR PRODUCTS DIVISION	HICKSVILLE NY	11802
15818	TELEDYNE SEMICONDUCTOR	MOUNTAINVIEW CA	94043
16299	CORNING GLASS WORKS COMPONENT DIVISION	RALEIGH NC	27604
16428	BELDEN CORP	RICHMOND IN	47374
17856	SILICONIX INCORPORATED	SANTA CLARA CA	95054
18324	SIGNETICS CORPORATION	SUNNYVALE CA	94086
18612	VISHAY RESISTOR PRODUCTS VISHAY INTERTECH	MALVERN PA	19355
18736	VOLTRONICS CORPORATION	HANOVER NJ	07936
18873	DUPONT E I DE NEMOURS & COMPANY	WILMINGTON DE	19801
19701	MEPCO/CENTRALAB ELECTRA CORPORATION	WEST PALM BEACH FL	33407
22526	DUPONT CONNECTOR SYSTEMS	CAMP HILL PA	17011
24226	GOWANDA ELECTRONICS CORPORATION	GOWANDA NY	14070
24355	ANALOG DEVICES INCORPORATED	NORWOOD MA	02062
24546	CORNING ELECTRONICS	SANTA CLARA CA	95050
24931	SPECIALTY CONNECTOR COMPANY INCORPORATED	GREENWOOD IN	46227
25088	SIEMENS CORPORATION	ISELIN NJ	08830
27014	NATIONAL SEMICONDUCTOR CORPORATION	SANTA CLARA CA	95052
27167	CORNING GLASS WORKS (WILMINGTON)	WILMINGTON NC	28401
27264	MOLEX PRODUCTS CO.	LISLE IL	60532
28480	HEWLETT-PACKARD CO CORPORATE HEADQUARTERS	PALO ALTO CA	94304
30043	SOLID STATE DEVICES INCORPORATED	LA MIRADA CA	90638
32559	BIVAR INCORPORATED	SANTA ANA CA	92705
34335	ADVANCED MICRO DEVICES INCORPORATED	SUNNYVALE CA	94086
34371	HARRIS SEMICONDUCTORS	MELBOURNE FL	32901
34649	INTEL CORPORATION	SANTA CLARA CA	95054
34899	FAIR-RITE PRODUCTS CORPORATION	WALLKILL NY	12589
52072	CIRCUIT ASSEMBLY CORPORATION	IRVINE CA	92714
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
71707	COTO CORPORATION	PROVIDENCE RI	02905
71468	ITT CORPORATION CANNON ELECTRIC DIVISION	SANTA ANA CA	92702
71785	TRW CONNECTORS	ELK GROVE VILLA IL	60007
72982	ERIE TECHNOLOGICAL PRODUCTS INCORPORATED	ERIE PA	16512
73597	GROOV-PIN CORPORATION	RIDGEFIELD NJ	04622
74970	EF JOHNSON COMPANY	WASECA MN	56093
75263	KEYSTONE CARBON COMPANY INCORORATED	ST MARY PA	15857
75915	LITTLEFUSE INCORPORATED	DES PLAINES IL	60016
76381	3M COMPANY	ST PAUL MN	55144
83125	NYTRONICS INCORPORATED CAPACITOR DIVISION	DARLINGTON SC	29532
83486	ELCO INDUSTRIES INC.	ROCKFORD IL	61109
91637	DALE ELECTRONICS INCORPORATED	COLUMBUS NE	68601
96733	SAN FERNANDO ELECTRIC MANUFACTURING COMPANY	SAN FERNANDO CA	91341
3L585	RCA CORPORATION SOLID STATE DIVISION	SOMERVILLE NJ	
8E175	BURR BROWN COMPANY	TUCSON AZ	35801
9M011	INTERNATIONAL RECTIFIER SEMICONDUCTOR DIVISION	EL SEGUNDO CA	90054
9N171	UNITRODE CORPORATION	LEXINGTON MA	02173
AROMT	AROMAT CORPORATION	MOUNTAINSIDE NJ	07092
D8351	MARQUARDT SWITCHES INCORPORATED	CAZENOVIA NY	13035
ELECN	ELECTRONIC CONCEPTS INCORPORATED	EATONTOWN NJ	

Table 6-6. Code List of Manufacturers (cont'd)

Mfr Code	Manufacturer's Name	Address		Zip Code
JSLYN	JOSLYN ELECTRONIC SYSTEMS DIVISION	GOLETA	CA	
UCMCN	UNITED CHEM-CON CORPORATION	LANCASTER	PA	17603
LINER	LINEAR TECHNOLOGY CORPORATION	MILPITAS	CA	
OPTEK	OPTEK	RICHARDSON	TX	09733
PNLCC	PANEL COMPONENTS CORPORATION	SANTA ROSA	CA	
PWCON	POWER CONVERSION INCORPORATED	MT VERNON	NY	
SEMNS	SIEMENS AG	MUNICH		8000
STRMC	STAR MICRONICS INCORPORATED	NEW YORK	NY	
S0562	TOSHIBA CORPORATION	TOKYO	JP	
UCMCN	UNITED CHEM-CON CORPORATION	LANCASTER	PA	17603

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section normally contains information necessary to adapt this manual to older instruments not directly covered by the current content. At this printing, however, the manual (and perhaps change sheets) does apply to all instruments. Therefore, no backdating information is included in this section.

7-3. Refer to Section I for information concerning manual coverage according to instrument serial number.

SECTION VIII
SERVICE

8-1. INTRODUCTION

This section contains information to aid in troubleshooting and repair of the HP 3457A Digital Multimeter. Included are safety considerations, theory of operation and troubleshooting procedures.

WARNING

The information contained in this section is intended for the use of service trained personnel who understand electronic circuitry and are aware of the hazards involved. Do not attempt to perform any of the procedures outlined in this section unless you are qualified to do so.

8-2. SAFETY CONSIDERATIONS

The HP 3457A is designed to meet international safety standards. To maintain these standards, the cautions, warnings, and other safety related information contained in this manual must be followed. Servicing of this instrument must be performed by service trained personnel.

WARNING

Any interruption of the protective grounding conductor (either inside or outside the instrument) or disconnection of the protective earth terminal will likely make the instrument dangerous. Intentional interruption of the protective grounding conductor is strictly prohibited.

The service information contained in this section normally requires removal of the protective covers and application of power. Voltages or signals at many points within the instrument may, if contacted, result in personal injury.

To protect personnel and prevent damage to the instrument, adjustment or repair with covers removed and power applied must be avoided as much as possible. When it becomes necessary to service the instrument under these conditions, the work must be performed by a skilled person who is aware of the hazards involved.

Be aware that it is possible for capacitors inside the instrument to remain charged when the instrument is turned off or when the power source has been disconnected.

Be certain that only the recommended fuse type (correct current rating, etc) is used for replacement. The use of repaired fuses or short circuiting the fuse holder is prohibited.

8-3. STATIC HANDLING

Static electricity is a familiar phenomenon which, except for an occasional shock, doesn't seem very serious. It has been proven in the electronics industry; however, that electrostatic discharge (ESD) is a major cause of component failure. In many cases, the component damaged may not fail immediately but cause poor instrument reliability and additional repairs at a later date. ESD damage can occur at static levels too low for human perception. It has been shown that ESD can affect both active and passive devices.

The following guidelines are the minimum requirements for a static-safe service environment:

- The work bench must be equipped with a conductive table mat. The mat should be connected to earth ground through a 1 Mohm resistor. The mat must be equipped with at least one connection for connecting wrist straps.
- All persons who handle and service the instrument must wear a conductive wrist strap in contact with bare skin. This wrist strap must be connected to the conductive table mat.
- All metal equipment at the work station must be grounded to earth ground. This includes soldering irons, desoldering tools, shelving, and equipment stands.
- Only one common ground can be provided at a work station.
- The work station must be kept free of nonconductive items such as common plastics, poly bags, cardboard, cigarette or candy wrappers. There must be no rugs or carpet on the floor, shelving or bench top.
- Proper containers must be used for shipping, storing and transporting assemblies.

8-4. RECOMMENDED TEST EQUIPMENT

Equipment to test and repair the HP 3457A is listed in Section I (Table 1-3) of this manual.

8-5. GENERAL BLOCK DIAGRAM THEORY OF OPERATION

The HP 3457A is a versatile, high precision digital multimeter capable of measuring AC or DC volts, AC or DC current, AC+DC volts or current, resistance, frequency, and period. It measures voltages up to 300 VAC or 300 VDC with high DC resolution and accuracy. Reading rates greater than 1000 readings per second can be achieved.

The following paragraphs provide a simplified explanation of the HP 3457A circuit operation. Refer to the simplified block diagram in Figure 8-1 for the following description.

The HP 3457A can be divided into two basic sections; the Chassis Common Circuitry and the Floating (isolated) Common Circuitry. The Chassis Common Circuitry provides instrument control and communication with other instruments, through the HP-IB, or the user through the front panel keyboard and display. The Floating Common Circuitry is responsible for converting the analog input signals to digital information. The two sections communicate with each other through the Isolation Logic Circuitry.

8-6. Chassis Common Circuitry

The Chassis Common Circuitry consists of digital circuits and associated power supplies. The main circuits are the Main Controller, HP-IB Input/Output, Front Panel Control and the Isolation Logic.

8-7. Main Controller

The Main Controller controls the HP 3457A's measurement process, communicates with the Front Panel and HP-IB I/O, applies measurement corrections and performs math calculations. The Main Controller circuitry consists of a microprocessor, program ROM's, storage RAM's and associated digital circuitry.

8-8. HP-IB I/O Circuitry

The HP-IB circuitry provides communication between the main controller and other instruments connected to the HP-IB bus. The HP 3457A main controller receives HP-IB commands (Remote, Listen, etc.) and control information (DCV, ACV, etc.) and sends measurement data through the HP-IB I/O circuitry.

NOTE

HP-IB is Hewlett-Packard's implementation of IEEE Standard 488-1978, "Standard Digital Interface for Programmable Instrumentation" and ANSI MC 1.1.

8-9. Front Panel Control

The Front Panel Control circuitry provides communication between the user and the Main Controller. The Main Controller microprocessor receives control information through the front panel keyboard and returns measurement information through the front panel display.

8-10. Floating Common Circuitry

The Floating Common Circuitry consists of Input Switching Circuitry, an Input Amplifier, an Ohms Current Source, an AC to DC Converter, an Analog To Digital Converter, a Voltage Reference, an A/D Controller, Isolation Logic Circuitry, and Power Supplies.

8-11. Input Switching

The Input Switching section is responsible for routing the input signal to the proper signal conditioning and measurement circuitry, and connecting the Ohms Current Source when making resistance measurements. The input switching is also used during Autocal and multimeter Self Test procedures to route stimulus and measurement signals.

8-12. Input Amplifier

The Input Amplifier scales the input signal to maintain a 0 to 10 volt signal to the input of the Analog to Digital Converter circuitry. The amplifier also provides isolation between the device being measured and the HP 3457A measurement circuitry.

8-13. Ohms Current Source

The Ohms Current Source supplies a known current through resistors being measured to provide a proportional voltage which can be measured by the HP 3457A. The current source is also used as a stimulus during the multimeter Self Test routine.

8-14. AC to DC Converter

The AC to DC Converter is a computing true rms converter which converts AC input signals up to 10 volts full scale and between 20 Hz and 1 MHz to an equivalent DC voltage for measurement by the HP 3457A.

8-15. Analog to Digital (A/D) Converter

The Analog to Digital Converter uses a multi-slope conversion process to convert the analog measurement data to digital information.

8-16. Voltage Reference

The Voltage Reference circuit, as the name implies, provides a stable voltage to the Analog to Digital Converter and the Ohms Current Source for measurement reference.

8-17. A/D Controller

The A/D Controller controls the measurement process. Function and range information received from the Main Controller is used to control the input switching and A/D converter. Measurement values are computed by the A/D Controller and then transmitted to the Main Controller through the isolation logic circuitry.

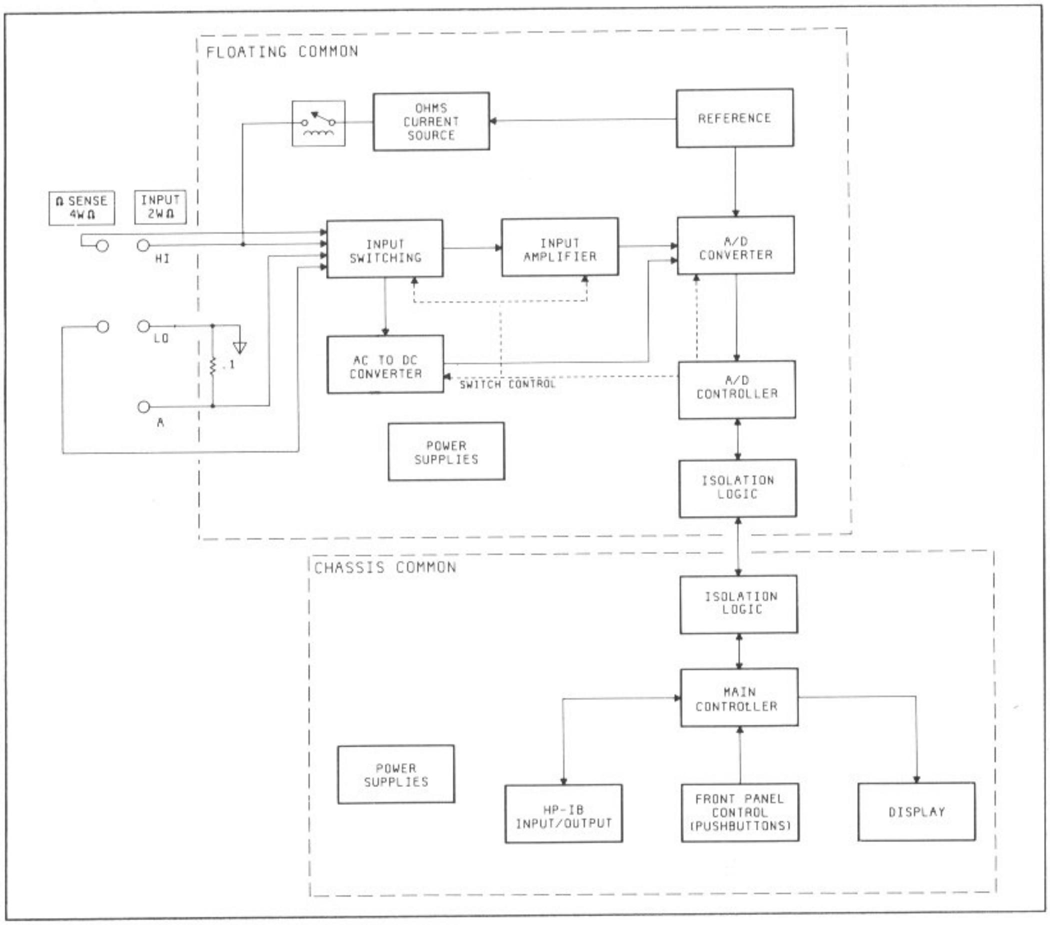

FLOATING COMMON
OHMS CURRENT SOURCE
REFERENCE
Ω SENSE 4WΩ
INPUT 2WΩ
HI
LO
A
.1
INPUT SWITCHING
INPUT AMPLIFIER
A/D CONVERTER
AC TO DC CONVERTER
SWITCH CONTROL
A/D CONTROLLER
POWER SUPPLIES
ISOLATION LOGIC
CHASSIS COMMON
ISOLATION LOGIC
MAIN CONTROLLER
POWER SUPPLIES
HP-IB INPUT/OUTPUT
FRONT PANEL CONTROL (PUSHBUTTONS)
DISPLAY

Figure 8-1. Multimeter Block Diagram

8-18. DETAILED THEORY OF OPERATION

The following sections give a detailed description of the operating circuitry in the HP 3457A Multimeter. The circuitry is explained as follows:

A. Input Circuitry
B. Ohms Current Source
C. A/D Converter
D. A/D Controller
E. Main Controller
F. AC to DC Converter

Refer to schematic A2/1 for the following discussion.

8-19. Input Circuitry

The purpose of the Input Circuitry is to condition the input signals to provide full scale 10V DC input voltages to the A/D Converter during full scale inputs to the multimeter. The input circuitry can be separated (and is explained) as follows:

Over Voltage/Over Current Protection
Input Switching
Autozero
Offset DAC
Pre-charge Stage and Pre-charge Offset Adjust
Input Amplifier

8-20. Over Voltage/Over Current Protection

This circuitry has four parts; high voltage protection, low voltage protection, current protection and ohms over voltage protection. The input terminals are protected from low energy static zap voltages to greater than 15KV, and high energy line transient impulses of greater than 3KV. The circuits operate as follows.

High Voltage Protection

The input terminals are protected from over voltage by a 450V Surge Voltage Protector (E101). Voltages greater than 450V peak cause E101 to breakdown thus clamping the terminals at approximately the value of RV101 (230V) plus the holdover voltage of E101 (approximately 100 volts).

Low Voltage Protection

The Input Hybrid, U101 is protected by diodes connected to the individual input nodes. The diodes on each node are connected internally in U101 to +3.5V and -3.5V power supplies. These diodes along with R101, R102, C101, R103, R408 and C401 maintain a current limited maximum input to the hybrid of approximately 3.5 volts. The capacitors C101 and C401 absorb the transient energy before the clamp diodes turn on. The ohms sense high and low inputs are also protected with clamp diodes, current limiting resistors and transient protection capacitors. In addition, L201, R205 and C203 form a filter to reduce the peak transient voltage at the collectors of Q214 and Q216 to less than 800V.

Ohms Over Voltage Protection

Transistors Q213 - Q216 form a protection network with a negative breakdown of 2BVce=700V. The resistors R213 and R214 provide the base bias for these transistors through the junction leakage current of Q212 in normal operation. For large negative overloads, the gate of Q212 will forward bias and provide a current path to ground. Positive breakdown of greater than +1KV is obtained through the reverse breakdown of CR201.

Amps Section Protection

Transient input protection of the AMPS section is provided by L401 along with clamp diodes CR401 - CR404. For any voltages (IRshunt) greater than approximately 1 volt, the input clamp diodes begin to turn on and shunt current away from the current shunt resistor thus preventing an over power condition from being sustained.

Current Protection

Fuse F101 in series with the current shunt (R401) protects the shunt from excessive inputs currents (>1.5A).

8-21. Input Switching

The input switching circuitry consists of relays and MOSFET switches. The MOSFET switches are located within input hybrid U101 and their purpose is to provide signal paths to the input amplifier and to connect the amplifier for a zero measurement (see Autozero in this section). The switches are controlled by circuits in U101 which receive their control information from the A/D Controller, U501 (schematic A2/2).

The input terminals are switched to the measurement front ends (DC, OHMS, AMPS, AC) through K101 - K104. The coil drive for these latching relays is a 15ms pulse of 5V originating in the 16 bit serial shift register U121 (schematic A2/2). This register is composed of 16 open drain VMOS devices which pull to ground. The register is not strobed so a strobe operation is provided through Q121 which provides a strobed +5V to the positive side of the relay coils and U121 provides the pull-down to ground.

Reed relays K106, K107, K201, K301 and K302 are selected by MOSFETs located in input hybrid, U101. These MOSFET coil select signals, U101 pins 27-30 and 35, are only designed to be able to pull down; therefore, drive current is provided by Q118. The combination of Q118, R118 and C118 provide a power on delay of approximately 1 second to allow the MPU (U501) time to properly program the desired state at initial power on. The combination of Q119, R122 and C117 provide protection for U402 and U101 in the event of an input hybrid latch-up condition. Should a latch-up condition occur, all relays could be on at the same time and U402 could be damaged. To prevent this, the combination of Q119 and R122 form a sense circuit that will detect an imminent latch-up condition and disable the +5V from all the reed relays controlled by U101. The resistor R122 provides a sense of the +15V supply current for the input hybrid. This current increases dramatically prior to the onset of latch-up and causes a voltage drop across R122 that controls the gate of Q119. Q119 is normally off except when U101 is in a latch-up condition. Should U101 enter a latch-up condition, Q119 will turn on and this will rapidly turn off Q118. Resistor R122 limits the +15V supply current to U101 during latch-up, thus it protects U101. The following explains the various input paths.

Low Range Input Path

The low range input path consists of K106, R101 and R102 plus U101 MOSFET switch 4. The purpose of the path is to connect the HI INPUT terminal to the input amplifier section. This path is used in the 30mV, 300mV and 3V DC volts ranges, all ranges of 2-wire and 4-wire ohms measurements and self test measurements.

High Range Input Path

The path consists of K107 and R103 plus U101 MOSFET switch 5 and a 100:1 divider (9.9M ohm and 100K ohm resistors). The purpose of the path is to attenuate input voltages by a factor of 100 and to connect the attenuated voltage to the input amplifier section. This path is used in the 30V and 300V DC ranges, 300M ohm - 3G ohm 2-wire and 4-wire ohms measurements, while command FIXEDZ is on and during self test. When this high range input path is selected, the input resistance is reduced from a resistance that is greater than 10G ohms on the low range input path to 10M ohms on this high range input path.

Ohms High Sense Path

This path consists of R201 and R202 plus U101 MOSFET switch 6. This path connects the HI OHMS SENSE terminal to the input amplifier section in the 4-wire ohms function. U101 MOSFET switch 6 (which is also part of the path) is used to connect the junction of U101 switch 6 to ground in all functions except 4-wire ohms. This is used to shunt any possible voltage on switch 6 to ground.

Ohms Low Sense Path

This path consists of R203 and R204 plus U101 MOSFET switch 7. This path connects the LO OHMS SENSE terminal to ground in the 4-wire ohms function.

Current Input Path

This path consists of R401 - R405, U403, R408 and U101 MOSFET switch 3. From the output of the front/rear switch, the input current under test, AC or DC, is routed to the AMPS section. Input currents are switched to shunt resistors R401 - R405 through relays K401 - K403 and scaled (IRshunt) to generate a 300mV full scale signal level. When changing amps ranges, the 1.0A range (R401) is always enabled to provide a continuous current path at the input terminals while the next range configuration is being selected. Once the new configuration is set, the 1.0A range switching (K401) is disabled. The relay configuration for the various current ranges is shown in table 8-1.

For DCI the voltage is sensed by input hybrid U101 at pin 40. The 1.0A range is sensed at the 0.1 ohm shunt (R401) through analog switch U403. For all other DCI ranges the sense is made at R405 through analog switch U403. For ACI measurements, the current shunts are configured identically to those for DCI with the only difference being the range bounds and the sense path. ACI ranges are from 1A to 30mA. For ACI the voltage is sensed at the junction of R403/R404 with K402 pins 9 - 13 and routed to the AC board (A3) through A2U402. From the AC board, the signal is routed through A2U403 pins 5 - 6 to input hybrid A2U101, pin 40.

On the 300uA current range the resolution for 6 digits is 100pA. This means that leakage currents from the current input lead may be very critical to the 300uA offset specification. To minimize the leakage current resulting from the clamp diodes, U401a is used as a bootstrap amplifier to force the voltage and the leakage current across CR401 and CR403 to be zero.

Table 8-1 Relay Configuration

RANGE	CONTACT CONNECTIONS	RESISTANCE VALUES
1.0A	K401 p4-6, 11-13 K402 p4-6, 11-13 K403 p13-9	0.1 OHM
300mA	K402 p4-8, 9-13 K403 p4-8	1.0 OHM
30mA	K402 p4-8, 9-13 K403 p4-6	10.0 OHM
3mA	K402 p4-6;K403 p13-11	100.0 OHM
300uA	K402 p4-6;K403 p13-9	1000.0 OHM

8-22. Autozero

The Autozero function is used to measure the offset (called a zero measurement) of the Input Amplifier and subtract it from the input measurement. When the Autozero function is enabled, a zero measurement is taken between each input measurement. The zero measurement is done in two different ways, depending on the function selected.

In the DC volts, DC current and 2-wire ohms functions, the zero measurement is made with U101 switch MC (measure customer) open and U101 switches MZ (measure zero) and $\overline{7}$ closed. Switches MZ and $\overline{7}$ connect the Input Amplifier to ground through a 102K ohm resistor. After the zero measurement is made, switches MZ and $\overline{7}$ open and switch MC closes for the input measurement.

In the 4-wire ohms function, the zero measurement is made with U101 switches MC and $\overline{7}$ open and U101 switches MZ and 7 closed. The input amplifier is connected to ground through the ohms low sense path (K102 pins 4-5 and J104) via an externally connected lead to the LO INPUT terminal (J102 and K101) which connects to ground. This measurement is different than the DC volts, DC current and 2-wire ohms functions because the input amplifier is connected to ground through the externally connected low ohms sense and lo input leads. This can cause a problem when scanning channels and using the measure command because its possible the sense and lo input leads can get separated. When this occurs, the resistance reading will be unstable. After the offset measurement is made, switches MC and $\overline{7}$ close and switches MZ and 7 open. The $\overline{7}$ switch closes to shunt any possible voltage on the junction of switch 7 to ground.

8-23. Offset DAC

The offset DAC section (U217, U122, U123 and U218) is used by both the A2 and A3 assemblies. The DAC provides a bipolar ±10V output in 1024 steps of approximately 2mV step size. A code of 0 programmed to the DAC yields an output voltage at JM102 of -10 volts while a code of 512 gives 0 volts and 1023 provides a full range output of +10 volts.

The DAC bits are written by MPU U501 (schematic A2/2) into the 16 bit serial shift register U122, 123 via line SDO. The 10 least significant bits of the register are connected to DAC U217.

The DAC provides a current output at pin 1 which is scaled to a voltage of 0 to -10 volts by U218b using the gain matched resistors in U217. The DAC output is referenced to the buffered +10 volt reference at U517a pin 7. Level shifting circuit U218a multiplies the output of the DAC from 0 to -10 volts to 0 to +20 volts and then shifts the output down by -10 volts to get a final output range of -10 to +10 volts at JM102.

Shift register U123 also provides miscellaneous control bits to the DCI switch U403 and AC ACAL source U402. The HTSO bit is the actual step used as the flatness ACAL source.

8-24. Pre-charge Stage and Pre-charge Offset Adjust

Pre-charge Stage

The pre-charge amplifier in U101 is used to pre-charge the stray capacitance at the input node of the input amplifier section. During a zero measurement, when Autozero is On, the input to the input amplifier is continuously switched between the input terminal through U101 switch MC and the analog ground through U101 switch MZ. The parasitic capacitance (approximately 10pf) at the amplifier input has to be charged and discharged. The charging current would come through switches MC and MZ if the pre-charge circuit were not present. This could load the input voltage and cause reading errors. To prevent this, the input of the input amplifier is pre-charged to the input voltage before the input measurement is made. This is done by the pre-charge amplifier and MOSFET switch PRE which are both located within U101. The operation is as follows:

A. After the zero measurement is made, switch PRE closes (switch MC is still open).

B. The input voltage is connected to the pre-charge amplifier using the input paths.

C. Since the pre-charge amplifier is a X1 gain amplifier, a voltage with the same polarity and value as the input voltage is applied through PRE to the input amplifier. This pre-charges the stray capacitance to the input voltage.

D. Switch PRE then opens and MC closes and an input measurement is made.

Pre-charge Offset Adjust

As previously stated, the pre-charge amplifier is used to pre-charge the input amplifier. However, the pre-charge amplifier itself also requires offset adjustment due to its offset voltage. Without it, the input through U101 switch MC would still need to provide a small amount of charging current for the input amplifier node stray capacitance. To further improve the instrument accuracy, the offset voltage of the pre-charge amplifier is greatly reduced by the Pre-charge Offset Adj circuitry, U216. The combination of U216, R216 and R217 form a voltage-to-current converter circuit. This circuit translates the 0 ±10 volt DAC output at JM102 to a 0 ±20uA current output at U216 pins 3 and 15. This current is used to reduce the input offset of the pre-charge amplifier in U101. The output impedance of the pre-charge amplifier in U101 is about 20K ohms so 1uA of current sourced from this unity gain amplifier reflects to its input as an offset of -20mV. This is used to null out the undesirable input offset voltage.

During an auto calibration procedure called OHMS PRE-CHARGE ACAL, U101's pre-charge amplifier offset voltage is calibrated to near zero. This is accomplished through an iterative measurement on the 300 Volt DC range with the input terminals open and K107 open. Two measurements are made using the 1 PLC mode, one measurement is made on the path through U101 switch MC and the other is made on the path through U101 switch PRE. After the two measurements are made, a correction value is computed and output. This procedure is repeated until a computed change of less than one DAC count is generated.

8-25. Input Amplifier

The purpose of the Input Amplifier, in conjunction with the Input Switching Circuitry, is to condition the input signals. The conditioning is done to apply the same full scale 10V DC voltage to the A/D Converter for all full scale inputs. The input amplifier must accomplish this task while at the same time introducing little or no error to the input signal.

The Input Amplifier is simply an op-amp whose gain is selected through MOSFET switches 8, 9 and 10 in U101. These switches select gains of 3.33, 33.3 and 333. Since the essential characteristics of a precision amplifier are not available in standard op-amps, discrete components must be used. The Input Amplifier section could be broken into three main blocks, Input Stage Bias, Input Gain Stage and Output Gain Stage. These are discussed below.

Input Stage Bias

The input gain stage (Q111, Q112) is designed to require a bias current of 400uA for proper operation. The circuitry composed of Q114, U112a, U112b and their associated 4 resistors comprise a precision current source to achieve this need. U112b generates a stable -12 volts and -10 volts used by U112a to force a 2 volt difference across R114. This forces a current of approximately 400uA (2V/5110 ohms) to flow from the emitter and into the collector of output transistor Q114.

Input Gain Stage

The input gain stage is designed to have exceptional gain linearity and common mode rejection to reduce measurement errors. The input FET, Q111, is the main element of this stage. Its characteristics determine the input current and input noise parameters of the amplifier. Cascode device Q112 is present to improve the CMRR properties of the first stage Q111.

The combination of Q113, U111a, R111 and R112 provide the net effect of a very large load resistor at the drain of Q112, pin 5. The effective resistance generated produces a gain (>300) much larger than could be produced with passive components. This circuit is called a Current Mirror because its operating characteristics force the same currents to flow in R111 and R112.

Since the low voltage range for the voltmeter is 30mV, the input amplifier offset voltage could be a large fraction of the total scaled input to the A/D converter. Adjustable resistor R113 is provided as a means of reducing the offset voltage and the potential errors it may generate. There is a diagnostic test, called Input Amplifier Offset Adjustment, that forces this offset to be adjusted to less than 500uV while Self Test checks it to limits of ±1.5mV.

Output Gain Stage

The final stage of the input amplifier is output gain stage U111b. U111b is configured an an integrator with C111 to provide additional gain and output drive to the A/D converter.

8-26. Ohms Current Source

The purpose of the Ohms Current Source is to provide a stable current for resistance measurements. The current is applied to the unknown resistance and the resultant voltage drop across the resistance is measured. All ohms ranges except the 30 ohm and the 300 ohm range generate a full scale of 3 volts. These ranges have 30mV and 300mV full scale voltages. To achieve this, precision current sources ranging from 1mA down to 100nA are needed. The ohms current source can be divided into 5 sections as follows:

Ohms Voltage Reference
Switch Amplifier
Output FET Gate Bias Amplifier
Offset Compensation Switching
Ohms Overload Protection

The following discusses each section except for the Ohms Overload Protection circuitry which was described earlier in the section titled Over Voltage Protection.

8-27. Ohms Voltage Reference

In order to achieve a precise and stable ohms function, the ohms current source is referenced to a very stable +10 volts. This +10 volt reference at U101 pin 4 is divided to values of 8 volts and 5.6 volts within input hybrid U101 and switched to ohms voltage reference amplifier U211 by U101 MOSFET switches 11 and $\overline{11}$. Eight volts is selected for all ranges below 30M ohm and 5.6 volts is selected for 30M ohm and above. The gain of U211 is set at X1.5 by the 17.1K and 2.9K ohm resistors within U101 and the 40K ohm resistor, R211.

8-28. Switch Amplifier

The switch amplifier (U212) receives an input voltage of either 12 volts or 8.4 volts from U211. U212 is a unity gain follower used to enable one of the four range resistors (4K, 40K, 400K or 4M ohm) in U101 that are used to set the output current value. When a range below 30M ohm is selected, the input to U212 will be 12 volts. This voltage will be applied to one of the four resistors by a pair of U101 MOSFET switches (12, 13, 14 or 15). The other side of the range resistors will always have 8 volts applied (refer to the following section entitled Output FET Gate Bias Amplifier); therefore, the current selected will be 4 volts/selected R. When a range of 30M ohm and above is selected the input to U212 will be 8.4 volts (1.5 x 5.6). This voltage will be applied to one of the four range resistors by a pair of U101 MOSFET switches discussed previously. The other side of the resistors will still have 8 volts applied; therefore, the current selected will be 0.4 volts/selected R.

Transistor Q211 allows a more linear operation of U212 (increased loop gain since it's not required to output a voltage so close to its limits). Without it, U212 would be required to output +12 volts from a supply of only +15 volts and linearity would not be as good.

8-29. Output FET Gate Bias Amplifier

Amplifier U213 in combination with the output MOSFET in U101 and switch amplifier U212 comprise a voltage-to-current Converter which is the Ohms Current Source. The noninverting input of U213 is driven by a voltage derived from the Ohms Voltage Reference Amplifier, U211. This input is maintained at +8 volts independent of the output of U211 by selecting one of two sense points in the gain network consisting of the 17.1K and 2.9K ohm resistors in U101. U101 MOSFET switch 11 will be on when the input to U211 is +8 volts and this voltage is switched to the input of U213. When the input to U211 is +5.6 volt, U101 MOSFET switch $\overline{11}$ will be on. This will select the +8 volts at the junction of the 17.1K and 2.9K ohm resistors in U101 and apply it to the input of U213. The operation of U213 then forces the inverting input of U213 to +8 volts as long as current can be made to flow through one of the range resistors (U101, 4K, 40K, 400K or 4M ohm). With a path for current to flow, the range resistor will have either 4 volts or 0.4 volts across it, thus generating a precise output current.

8-30. Offset Compensation Switching (OCOMP command)

The ohms function can be thought of as simply measuring the voltage across a resistor that has a precision current passed through it. However, if there are unwanted voltages in the path, errors will be introduced. For example, the error voltage may be a thermally generated offset in the resistor under test. If this unwanted voltage could be eliminated from the desired voltage, then potentially large sources of error in the measurement could be removed.

Offset compensation is a technique which removes sources of errors. While in the ohms mode, a measurement is periodically made with the ohms current source off. This result is the error voltage we want to remove. This value is subsequently subtracted from normal ohms readings to yield an error free result.

Analog switch U214 is used to switch the ohms current source on and off. The function of U213 is to control the gate voltage and thus the current flowing to U101 pin 15 from the output MOSFET in U101. When the gate voltage is positive the current source is off. The purpose of U214 is to toggle between current source on (switch from pins 1-16 on) and current source off (switch from pins 3-4 on).

Independent of offset compensation, the network composed of R218, Q217 and CR202 provides an alternate current path when the output MOSFET in U101 is off. Without this network, the combination of the range resistors (4K, 40K, 400k and 4M ohm) in U101 and stray capacitance at the inverting input of U213 can cause stability problems on the higher ohms ranges. With this network, when the output of U213 approaches -7.5 volts, the diode connected low leakage JFET Q217 forward biases and output current is diverted away from the ohms output MOSFET.

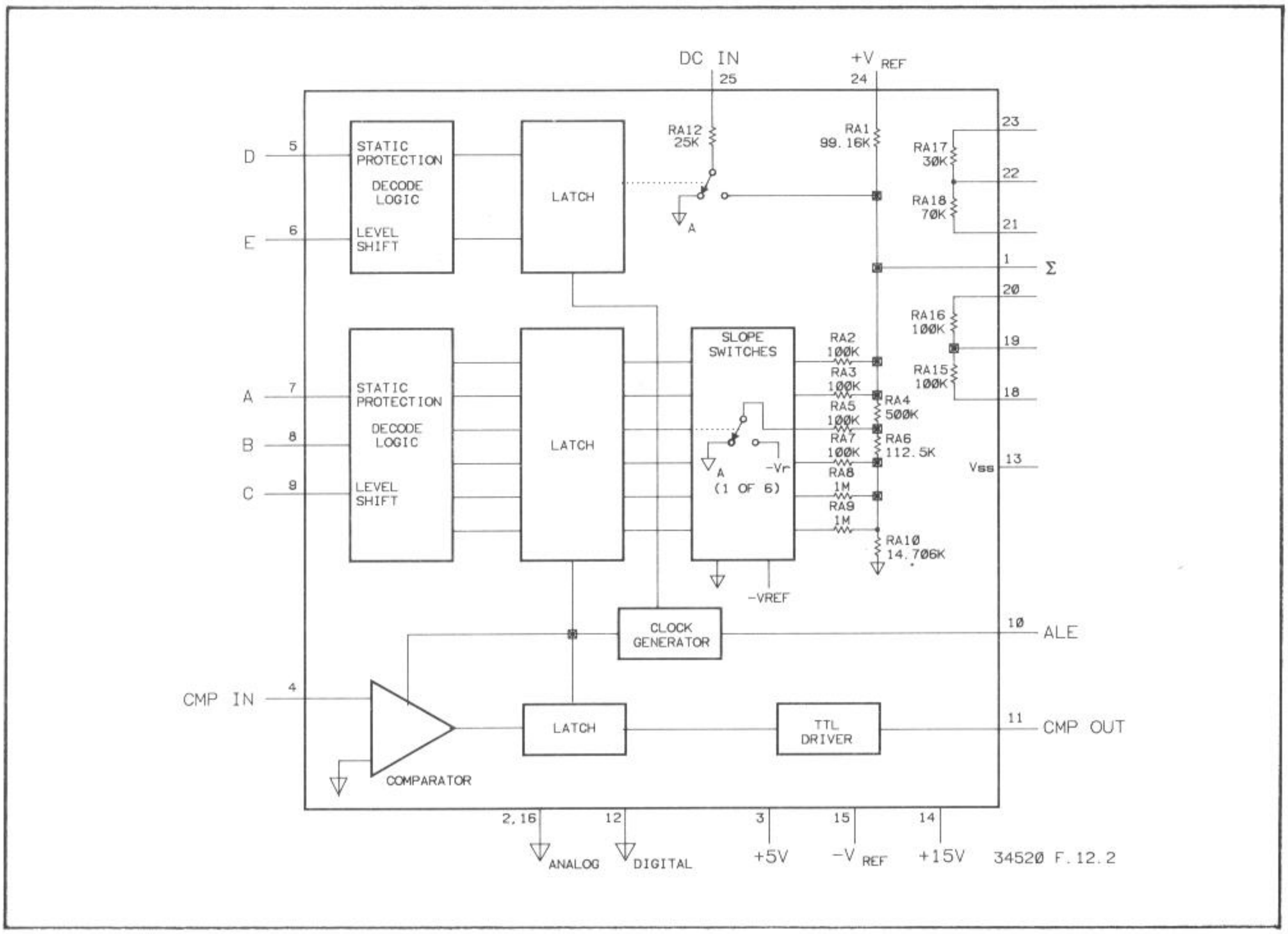

DC IN
25
+V REF
24
D
5
E
6
STATIC PROTECTION
DECODE LOGIC
LEVEL SHIFT
LATCH
RA12 25K
RA1 99.16K
A
RA17 30K
RA18 70K
23
22
21
1
Σ
20
RA16 100K
19
RA15 100K
18
A
7
B
8
C
9
STATIC PROTECTION
DECODE LOGIC
LEVEL SHIFT
LATCH
SLOPE SWITCHES
A
-Vr
(1 OF 6)
RA2 100K
RA3 100K
RA4 500K
RA5 100K
RA6 112.5K
RA7 100K
RA8 1M
RA9 1M
RA10 14.706K
Vss
13
-VREF
CLOCK GENERATOR
10
ALE
CMP IN
4
COMPARATOR
LATCH
TTL DRIVER
11
CMP OUT
2, 16
ANALOG
12
DIGITAL
3
+5V
15
-V REF
14
+15V
34520 F.12.2

Figure 8-2. A/D Hybrid (U511)

8-33. A/D Analog

The A/D Analog section consists of the A/D Integrator, Slope Amplifier, DA Compensation and Analog Auto-Zero Loop. In addition to the A/D Hybrid (U511), this is all the analog circuitry required to make the A/D Converter operate. Each section is discussed below.

A/D Integrator (U512 and associated circuitry)

The function of the integrator is to accumulate charge from the unknown input current signal so it can later be nulled out by using currents of known value. The A/D Integrator consists of a high speed amplifier with a capacitor (C511) in its feedback loop from output to (-) input. In this instrument, the amplifier is a composite of Q514, U512 and the associated bias components. Transistor Q514 functions as a low input current, low current noise, input gain stage for integrator amplifier, U512.

Since the algorithm that controls the A/D Integrator operation is zero seeking, the maximum voltage present at the output of the integrator amplifier U512 is bounded in normal operation. However; for abnormal conditions, such as an extreme overload, the integrator could enter a condition where the output may not be returned to zero in the alloted time. To eliminate this condition, comparator U515a is utilized to detect both plus and minus illegal voltages (±6.3 volts) on the integrator and flag the MPU. This allows MPU U501 to abort the current integration, disconnect the input, flag an overload condition and provide extra time to guarantee a return to zero for the integrator.

Slope Amplifier (U513)

There are three key components that form the kernel of operation of an integrating A/D converter. These are the current sources and steering switches in the A/D Hybrid U511, the integrator amplifier, and the comparator. Of these, the comparator is where the translation from the analog domain to the digital domain occurs. Therefore; the sensitivity and response time of the comparator are critical to the final A/D performance. The comparator is located in A/D hybrid U511 and has its input on pin 4.

In order to reduce the voltage sensitivity requirements and enhance the available input overdrive of the comparator, an amplifier (U513) is inserted between the output of the integrator amplifier and the comparator input. Its primary purpose is to amplify the smaller slopes before the comparator input. This offers improved resolution of slope zero crossing detection. Since this is its function, it's generally referred to as the Slope Amplifier. This amplifier provides an inverting gain of 20.

DA Compensation (U514 and Q512)

The Multi-Slope conversion technique is inherently zero seeking, that is it tends to keep the average voltage on the integrator capacitor (C511) near zero. However; there is still a residual error which is small but still tends to bias the average integrator voltage to be other than zero. This can introduce linearity errors. This residual error results from the "charge memory" or dielectric absorption (DA) of the integrator capacitor. To minimize the nonlinearities caused by the integrator capacitor DA, a unique DA COMPENSATION circuit has been implemented. The circuit is composed of U514a and its gain network along with FET switch Q512. During the run-up phase of the A/D conversion the DA Compensation amplifier is connected to the summing node of slope amplifier U513 through Q512.

A/D Analog Auto-Zero Loop

Precision A/D performance can only be achieved by the elimination of all potential error sources. For an integrator to yield accurate, repeatable results, its operation must be precisely controlled. The most critical aspect is being able to provide a controlled starting and ending condition for the integrator. This is the function of the Analog Auto-Zero Loop.

In this instrument, the Analog Auto-Zero Loop seeks a zero current condition for the integrator and stores the necessary correction to force this condition. The Analog Auto-Zero Loop (AAZ) is enabled between each conversion for 2mS and is also the standby mode for the A/D.

The Analog Auto-Zero Loop is composed of the integrator amplifier circuitry, the slope amplifier and the hold circuitry. The hold circuitry is formed by the sampling FET Q511, the hold capacitor C512, hold follower Q513 and divider R519, R520.

Between readings FET switch Q511 is closed. This connects the slope amplifier (U513) output to the auto-zero hold capacitor C512. The voltage of C512 is followed (X1 gain) by FET pair Q513. The hold voltage at Q513b, pin 5 is then attenuated by the R519, R520 divider (X0.1) in order to reduce the effects of noise and hold capacitor leak-down rate errors. The divided voltage is then applied as the offset correction for the integrator at its plus input, Q514, pin 6.

FET switch Q515 is present to short out the noise of the Analog Auto-Zero Loop and also the correction voltage, during the run-up interval. Since the primary purpose of the Analog Auto-Zero Loop is to define a precise zero for the run-down interval, shorting Analog Auto-Zero during run-up will have minimal error effect.

8-34. Voltage Reference

To maintain long term accuracy of a DVM, a precision Voltage Reference is required. This instrument uses a pretested voltage reference assembly with superior stability. The reference assembly plugs onto the A2 assembly. In conjunction with the reference assembly, reference gain resistors inside the A/D hybrid (U511) are used to generate the primary -10 volt instrument reference voltage. Amplifier U516 along with other resistors in U511 provide a precision inverter for generation of the +10 volt reference. Buffer transistor Q522 is used to provide a low output impedance for the -10 volt reference over a wide frequency range. Bias resistor R532 aids in this by supplying a continuous bias of 2mA from Q522.

8-35. A/D Controller

The following discussion refers to the A/D Controller circuitry which is located on schematic A2/2. The A/D Controller can be divided and is explained as follows:

A/D Control
Frequency Counter
Floating Common Microprocessor
Cross-Isolation Link

8-36. A/D Control

The A/D input signal is integrated during the run-up phase of the conversion cycle and the multi-slope conversion technique actually starts accumulating the most significant digits of the reading during run-up. For the run-up interval, the microprocessor has control of the slope decisions on a real time basis and the slopes are finite increments of time (6uS of S±4 and 1uS of S±0). The microprocessor accumulates the total number of each slope type used. For slopes in run-down, slope control is performed by external logic. This logic removes some slope decisions from the microprocessor; therefore, measurement throughput is increased. The run-down phase of the conversion cycle is discussed below.

During run-down the initial slope (S±4) is decided by the microprocessor and output to the A/D hybrid U511, pins 7-9 through the slope control bits at U501, pins 3-5. Gates U508a, 508b, and 508d along with U507a and U502d form a feedback circuit which turns off slopes immediately following a run-down zero crossing as detected by the comparator output at U511, pin 11. This hardware is necessary to keep slope overshoot time, the time from zero crossing detection to slope turn off, to a minimum. Due to noise, it is possible for the slope shut off system (U502/U507) to oscillate once when the comparator goes through zero on the final slope. To prevent this, U508c latches the comparator transition selected by U507a.

The final aspect of run-down is the actual measurement of the slope times. A 20 bit counter is used to accumulate time intervals of the run-down slope. This counting is performed by the MPU internal counter (U501, pin 14) prescaled by a 4 bit counter U506.

Time interval measurements must be made with extreme precision and repeatability to achieve the necessary accuracy. This requires low phase noise from the clock oscillator. The clock output ALE (U501, pin 30) must be re-clocked by U503a to provide a phase stable, repeatable clock to the A/D hybrid (U511) and the external time interval counter (U506). U506 counts this phase stable 2MHz when enabled by input multiplexer U507b, pin 9. Multiplexer U507b selects one of three inputs as the counter enable input (U506, pin 7). The three inputs are either Slope Control A from U508a pin 1, Slope Control B from U508d pin 13 or the frequency gate signal from U503b pin 9. This time becomes the time interval that is measured. Upon completion of a time interval measurement, the data present in U506 is read by the MPU (U501) and combined with the internal MPU counter (U501, pin 14) to determine the total time interval measured.

8-37. Frequency Counter

The AC assembly, A3, provides a convenient front end for frequency measurements. The ranging capability can accept input signals over a wide dynamic range of 10mV - 300 volts and frequency measurements can be made on the function selected by the FSOURCE command. First, an A/D measurement is performed to determine the optimum range, voltage or current, for the frequency measurement. This provides input signal conditioning without user intervention.

The A/D converter has external digital hardware used for run-down slope TIME INTERVAL measurements. Since both frequency and A/D results can not be performed simultaneously, the frequency counter utilizes this same hardware to accumulate a portion of its result. Frequency is defined as CYCLES/SECOND. This can be interpreted as ZERO CROSSINGS/TIME INTERVAL and is precisely what the multimeter has done.

One of the inputs to the prescaler counter U506 is the Frequency Gate signal. This is selected through U507b. Notice that the inputs of U506 are the Q outputs of another counter U505. U505 is also a prescale counter but it prescales MPU (U501) internal counter T1 at U501 pin 15 while U506 prescales MPU internal counter T0 at U501 pin 14. These two counters convert the frequency of the FREQ signal input from the A3 assembly to an appropriate count.

At the start of a frequency conversion, MPU U501 outputs a measurement gate (U501 pin 16) of approximately 0.5 second. With the measurement gate signal set, flip-flop U503b will respond with its Q (FREQ GATE) output going high at the next rising edge of the FREQ IN signal at U503b pin 11. The FREQ GATE signal enables both the time interval (U506) and zero crossing (U505) counters as long as the MPU holds the measurement gate signal high (U501 pin 16). Counter U505 therefore measures the number of zero crossing during the gate and counter U506 measures the "actual" measurement gate interval with 0.5uS resolution. Frequency is computed from these results. This technique yields a constant measurement resolution of 1ppm independent of the input frequency with an approximate 2 readings/second conversion rate.

8-38. Floating Common Microprocessor

The floating common MPU U501 is responsible for all aspects of the Analog Section operation. It controls all the measurement dynamics and adds the calibration correction to the finished reading. For example, during the A/D conversion process, MPU 501 is completely occupied with control and interaction with A/D hybrid U511, input hybrid U101 and external logic. This maintains a constant conversion time. For each measurement configuration, the A1 Main Controller sends the appropriate calibration constants to U501. These constants are used to correct the measurement just completed.

Analog section set-up is performed through serial registers in essential areas. Communication to these registers is accomplished through a common serial data path, SDO (Serial Data Output) generated by U501. Individual registers are addressed to receive data by clocking data only to the desired register through the SDCn control lines which are also generated by U501. There are five control lines, SDC2-SDC6, that address serial registers. The register number, the name of the register and the components switched are as follows.

2 PLUG-IN MODULES (44491, etc)
3 RELAY CONTROL (RL) -- A2Q121, A2U121
4 MISCELLANEOUS LOGIC CONTROL (ML) -- A2U122, A2U123
5 AC -- A3U315, A3U316
6 INPUT HYBRID (IH) -- A2U101

8-39. Cross-Isolation Link

In order to make precision floating measurements, the impedance from isolated assembly A2 to earth ground should be large. Only two electrical paths need to be high impedance for this to occur, the floating common power supply and the communications path between the A2 and A1 MPU's. The power supply isolation occurs inside the power transformer. The communications link isolation is achieved through opto-isolators U509 and U510.

Communications between the A1 and A2 assemblies is accomplished through a full duplex UART link on each assembly and the opto-isolators. The link operates at a 187KHz rate. Data is received and transmitted in 11 bit frames consisting of one start bit, eight data bits, one even parity bit and one stop bit.

MPU A2U501 will be RESET when all zeros have been sent over the communications link for a period greater than 20mS.

8-40. Main Controller (03457-66501)

Refer to schematic A1/1 for the following discussion.

The Main Control Assembly manages the overall operation of the instrument. This includes managing the measurement process, performing mathematical calculations, storing data, and communicating with the front panel and with other instruments connected to the interface bus.

The Main Controller consists of microprocessor U501, two ROM's (U502 and U503) and two RAM's (U506 and U511). The ROM's contain the operating routines for the microprocessor while the RAM's provide temporary memory. RAM U511 contains the calibration and auto calibration constants, the HP-IB address of the instrument, and instrument configuration states selected by the user.

8-41. Reading instructions from ROM U503.

To read instructions from ROM U503, the microprocessor:

- Sets the read/write ($R/\overline{W}$) output (U501, pin 32) high.

- Sets the address code, of the memory location to be read, onto address lines A0 through A12.

- Sets address lines A13 and A14 high and sets A15 low to enable ROM U503.

The positive portion of timing signal E+Q (U597a, pin 1) and the high $R/\overline{W}$ signal sets the output of gate U598d ($\overline{RD}$) low to activate the output of ROM U503. The microprocessor then reads the information from data bus "A", lines D0 through D7.

8-42. Reading instructions from ROM U502.

To read instructions from ROM U502, the microprocessor:

- Sets the read/write ($R/\overline{W}$) output (U501 pin 32) high.

- Sets the address code, of the memory location to be read, onto address lines A0 through A14.

- Sets address line A15 high to enable gate U598b.

The combination of the positive portion of timing signal E+Q and the high $R/\overline{W}$ signal causes a negative pulse at the output of gate U598d ($\overline{RD}$). Simultaneously, the positive portion of timing signal E+Q and the high A15 signal cause a negative pulse at the output of U598b ($\overline{ROM}$).

The negative $\overline{ROM}$ signal activates the output of ROM U502 and causes a negative pulse at the output of gate U596b to enable tri-state buffer U517. The negative $\overline{RD}$ signal from U598b activates the output of buffer U517. The microprocessor then reads the information from primary data bus "A", lines D0 through D7.

8-43. Reading information from RAM U506.

To read information from RAM U506, the microprocessor:

- Sets the read/write ($R/\overline{W}$) output (U501, pin 32) high.

- Sets the address code, of the memory location to be read, onto address lines A0 through A10.

- Sets address line A11 high and lines A12 and A13 low to select the $\overline{RAM}$ output of decoder U513.

- Sets address lines A14 high and A15 low to enable decoder U513.

The low portion of timing signal $\overline{E+Q}$ (U597b, pin 4) activates the $\overline{RAM}$ output of decoder U513 to enable RAM U506. The positive portion of timing signal E+Q and the high $R/\overline{W}$ signal pulses the output of gate U598d ($\overline{RD}$) low to activate the output of RAM U506. The microprocessor then reads the information from data bus "A", lines D0 through D7.

8-44. Reading information from RAM U511.

To read information from RAM U511, the microprocessor:

- Sets the read/write ($R/\overline{W}$) output (U501, pin 32) high.

- Sets the address code, of the memory location to be read, onto address lines A0 through A10.

- Sets address lines A11 and A13 low and A12 high to select the $\overline{NVRAM}$ output of decoder U513.

- Sets address lines A14 high and A15 low to enable decoder U513.

The low portion of timing signal $\overline{E+Q}$ (pin 4 of gate U597b) activates the $\overline{NVRAM}$ output of decoder U513. The $\overline{NVRAM}$ signal is applied to the emitter of Q501 and causes a negative pulse at the collector ($\overline{NVCS}$) to enable RAM U511. The positive portion of timing signal E+Q and the high $R/\overline{W}$ signal pulses the output of gate U598d ($\overline{RD}$) low to activate the output of RAM U511. The microprocessor then reads the information from data bus "A", lines D0 through D7.

8-45. Writing information to RAM U506.

To store information in RAM U506, the microprocessor:

- Sets the read/write (R/$\overline{\text{W}}$) output (U501, pin 32) low.
- Sets the address code, of the memory location where the information is to be stored, onto address lines A0 through A10.
- Sets address line A11 high and lines A12 and A13 low to select the $\overline{\text{RAM}}$ output of decoder U513.
- Sets address lines A14 high and A15 low to enable decoder U513.

The low portion of timing signal $\overline{\text{E+Q}}$ (U597b, pin 4) activates the $\overline{\text{RAM}}$ output of decoder U513 to enable RAM U506. The output of U598a ($\overline{\text{WR}}$) is pulsed low by the high portion of timing signal E+Q and the high $\overline{\text{R}}$/W signal from inverter U599e. This activates the input of RAM U506. The microprocessor then writes the information to U506 through data bus "A", lines D0 through D7.

8-46. Writing to the unprotected section of RAM U511.

To write to the unprotected section of RAM U511, the microprocessor:

- Sets the read/write (R/$\overline{\text{W}}$) output (U501, pin 32) low.
- Sets the address code, of the memory location where the information is to be stored, onto address lines A0 through A10. (*When addressing the unprotected section of U511, address lines A9 or A10 or both will be set low.*)
- Sets address lines A11 and A13 low and A12 high to select the $\overline{\text{NVRAM}}$ output of decoder U513.
- Sets address lines A14 high and A15 low to enable decoder U513.

The low portion of timing signal $\overline{\text{E+Q}}$ (U597b, pin 4) activates the $\overline{\text{NVRAM}}$ output of decoder U513. The $\overline{\text{NVRAM}}$ signal is applied to the emitter of Q501 and causes a negative pulse at the collector ($\overline{\text{NVCS}}$) to enable RAM U511. The output of gate U595d is pulsed low by the positive portion of the Q timing signal (U501, pin 35) and the inverted R/$\overline{\text{W}}$ from inverter U599e. This causes the output of gate U591a (NVWR) to go high. During this time, a low signal on address line A9 or A10 ensures a low output from U596a. The high NVWR signal is applied to the base of Q500 through gate U594b, causing it to conduct. The low output of Q500 ($\overline{\text{NVWE}}$) activates the input of RAM U511. The microprocessor then writes the information to U511 through data bus "A", lines D0 through D7.

8-47. Writing to the protected section of RAM U511.

The "Write to CAL-RAM" sequence begins with a **CAL** command, either from the interface bus or from the front panel. The microprocessor is reset prior to each calibration routine to insure that valid measurements are obtained.

Calibration Reset. Upon receiving the **CAL** command, the microprocessor stops toggling the $\overline{\text{INOP}}$ signal and waits for the circuit to time out and reset as follows:

- A continually low (or high) $\overline{\text{INOP}}$ signal applied to capacitor C505 allows the input of inverter U591b to go low.

- The high output of U591b and the normally high $\overline{\text{RESET}}$ signal applied to the inputs of gate U598c cause its output to be held low, disabling the reset to U514 and U515.

- Counters U514 and U515 count the 2 MHz clock signal applied to U514, pin 10. After counting for 524288 µsec. (from the last reset), the output of U515 pin 9 is set high.

- The high output of U515 pin 9 is applied to the minus input of comparator U519a causing its output to go low. The low output from U519a is applied to the plus input of comparator U519d causing its output to go low.

- The low output of U519d is coupled through buffer U594d to the $\overline{\text{RESET}}$ input (U501 pin 37) of the microprocessor; to gate U598c, which causes its output to go high and reset counters U514 and U515 to zero; and to "flip-flop" U592b. Clearing U592b sets its $\overline{\text{Q}}$ output high to remove the low signal from the CLR input of U592a, pin 15.

CAL-RAM Lock circuit operation. The CAL-RAM Lock circuit protects the instruments calibration constants by preventing accidental writing to the protected (calibration) section of RAM U511.

- After being reset, counters U514 and U515 begin to count the 2 MHz clock signal applied to U514, pin 10.

- The output of counter U514 (pin 3) is set high 4096 µseconds after the circuit reset. This signal sets the "J" input of flip-flop U592a high, enables gate U595b, and insures that the output of gate U591d is kept low.

- The microprocessor sets address lines A11 and A12 high and line A13 low to select the $\overline{\text{CALREQ}}$ output of decoder U513.

- The negative portion of timing signal $\overline{\text{E+Q}}$ (U513, pin 4) activates the $\overline{\text{CALREQ}}$ output of decoder U513. The $\overline{\text{CALREQ}}$ signal must occur between 4096 and 4100 µsec. after the circuit reset has occurred to be valid.

- The negative $\overline{\text{CALREQ}}$ pulse clocks the high "J" input into flip-flop U592a which sets output signal $\overline{\text{NVE}}$ low. The following section titled CAL-RAM Write Operation explains how this enables the write input of RAM U511.

  If the $\overline{\text{CALREQ}}$ signal is applied to gate U591d while the 4096 usec. signal is low, the output of U591d will be set high, which sets the output of gate U591c low to reset flip-flop U592b. The low $\overline{\text{Q}}$ output of U592b clears flip-flop U592a to "lock" the circuit. Also, if the 4096 usec. signal is low when the $\overline{\text{CALREQ}}$ signal is applied to the clock input of U592a, the $\overline{\text{Q}}$ output will remain high (locked).

CAL-RAM Write operation. Once the CAL-RAM Lock circuit has been "unlocked" ($\overline{\text{NVE}}$ set low), the microprocessor:

- Sets the address code, of the memory location where the information is to be stored, onto address lines A0 through A10. (*When writing to the protected section of U511, address lines A9 and A10 will be set high.*)

- Sets address lines A11 and A13 low and A12 high to select the $\overline{\text{NVRAM}}$ output of decoder U513.

- Sets address lines A14 high and A15 low to enable decoder U513.

The low portion of timing signal $\overline{\text{E+Q}}$ (U597b, pin 4) activates the $\overline{\text{NVRAM}}$ output of decoder U513. The $\overline{\text{NVRAM}}$ signal, applied to the emitter of Q501, causes a negative pulse at the collector ($\overline{\text{NVCS}}$) to enable RAM U511. The output of gate U595d is pulsed low by the positive portion of the Q timing signal (U501, pin 35) and the inverted R/$\overline{\text{W}}$ signal from inverter U599e. This causes the output of U591a (NVWR) to go high. During this time, the low $\overline{\text{NVE}}$ signal ensures a low output from gate U596a. The NVWR signal is applied to the base of Q500 through gate U594b, causing it to conduct. The low output of Q500 ($\overline{\text{NVWE}}$) activates the input of RAM U511. The microprocessor then writes the information to U511 through data bus "A", lines D0 through D7.

After completing the write to CAL-RAM, the microprocessor toggles the $\overline{\text{INOP}}$ signal at U510, pin 19. The positive $\overline{\text{INOP}}$ pulse is applied to gate U591c. The negative pulse from the output of U591c presets J-K flip-flop U592b, setting its $\overline{\text{Q}}$ output low. The low $\overline{\text{Q}}$ output from U592b clears J-K flip-flop U592a, setting its $\overline{\text{Q}}$ output high to remove the RAM write enable signal ($\overline{\text{NVE}}$) and "lock" the circuit. The $\overline{\text{INOP}}$ signal also resets counters U514 and U515.

The CAL-RAM Lock operation and CAL-RAM Write operation is performed a total of five times for each calibration command. The Calibration Reset operation; however, is performed only once.

8-48. Reset Circuit Operation

The purpose of the reset circuit is to set the microprocessor to a known state. The reset circuit is active under the following conditions:

- At "power-on".
- When the +5 volt power supply is low.
- If the microprocessor goes to a non-operational state.
- At the beginning of a calibration or auto calibration routine.

Power-on Reset. The power-on reset circuit consists of comparators U519b and U519d, buffer U594d and battery BT501.

The minus input of comparator U519b is referenced to +3 volts by battery BT501. The plus input of U519b is connected through a voltage divider to the +5 volt un-regulated power supply. At initial power-on, the plus input to U519b is less than the +3 volt reference on the minus input and the output is held low. The low output of U519b is applied to the plus input of U519d, holding its output low. The low output of U519d is coupled through buffer U594d to the $\overline{\text{RESET}}$ input of the microprocessor.

As the power supply reaches operating voltage, the voltage at the plus input of U519b exceeds the reference voltage at the minus input and the output goes positive. The positive output of U519b applied to the plus input of comparator U519d causes its output to go high. The high output of U519d is coupled through buffer U594d to the $\overline{\text{RESET}}$ input of the microprocessor to release it from the RESET state.

Low Power Reset. If the un-regulated +5 volt power supply should drop below approximately +7 volts, the plus input of comparator U519b drops below the +3 volt reference at the minus input causing the output to go low. The low output of U519b is applied to the plus input of U519d causing its output to go low. The low output of U519d is coupled through buffer U594d to the $\overline{\text{RESET}}$ input of the microprocessor. The processor is held in a RESET condition until the un-regulated +5 volt supply returns to normal.

Microprocessor Inoperative Reset. Under certain conditions it is possible for the microprocessor to "lock-up" or become non-operational. During normal operation, the microprocessor continually toggles the $\overline{\text{INOP}}$ signal at U510, pin 19. If the $\overline{\text{INOP}}$ fails to toggle, the processor is reset by the Watch Dog circuit as follows:

A continually high or low $\overline{\text{INOP}}$ signal applied to capacitor C505 allows the input of inverter U591b to go low. The high output of U591b and the normally high $\overline{\text{RESET}}$ signal applied to the inputs of gate U598c cause its output to go low and reset counters U514 and U515. After being reset the counters begin counting the 2 MHz clock signal applied to U514, pin 10. After counting for slightly more than 0.5 seconds the output of counter U515 pin 9 is set high. The high output of U515 is applied to the minus input of comparator U519a causing its output to go low. The low output from U519a is applied to the plus input of comparator U519d causing its output to go low. The low output of U519d is coupled through buffer U594d to the $\overline{\text{RESET}}$ input of the microprocessor to reset it. The $\overline{\text{RESET}}$ signal from buffer U594d is also applied to gate U598c causing its output to go low and reset counters U514 and U515.

Calibration Reset. The microprocessor is reset prior to each calibration routine to insure that valid measurements are obtained. When calibration is requested, the microprocessor stops toggling the $\overline{\text{INOP}}$ signal at U510 pin 19, and waits for the circuit to time out as follows:

A continually high or low $\overline{\text{INOP}}$ signal applied to capacitor C505 allows the input of inverter U591b to go low. The high output of U591b and the normally high $\overline{\text{RESET}}$ signal applied to the inputs of gate U598c cause its output to go low and reset counters U514 and U515. After being reset the counters begin counting the 2 MHz clock signal applied to U514, pin 10. .After counting for slightly more than 0.5 seconds the output of counter U515 pin 9 is set high. The high output of U515 is applied to the minus input of comparator U519a causing its output to go low. The low output from U519a is applied to the plus input of comparator U519d causing its output to go low. The low output of U519d is coupled through buffer U594d to the $\overline{\text{RESET}}$ input of the microprocessor to reset it. The $\overline{\text{RESET}}$ signal from buffer U594d is also applied to gate U598c causing its output to go low and reset counters U514 and U515.

8-49. Main Controller (03457-66511)

Beginning with serial number 2538A02954, 3457A's were shipped with a new main controller board, the 03457-66511. This board works similar to the original main controller, the 03457-66501, and is completely backwards compatible. The following sections describe operation of the new main controller in detail.

Refer to schematic A11/1 for the following discussion.

The Main Control Assembly manages the overall operation of the instrument. This includes managing the measurement process, performing mathematical calculations, storing data, and communicating with the front panel and with other instruments connected to the interface bus.

The Main Controller consists of microprocessor U601, one ROM (U602) and one RAM (U603). The ROM contains the operating routines for the microprocessor while the RAM provides both volatile and nonvolatile memory. Items stored in the nonvolatile memory of RAM are the calibration and auto calibration constants, the HP-IB address of the instrument, and instrument configuration states selected by the user.

8-50. Reading instructions from ROM U602.

To read instructions from ROM U602, the microprocessor:

- Sets the read/write ($R/\overline{W}$) output (U601, pin 32) high.
- Sets the address code of the memory location to be read onto address lines A0 through A15.
- For the ROM to be enabled, one or more of A13-15 address lines must be high. U602 is enabled by the output of the NOR gate U606a. Being enabled only when one of the address lines, A13-A15, is high, effectively maps microprocessor memory locations 2000-FFFF (hex) into ROM U602.

The positive portion of timing signal E+Q (U624a, pin 3) and the high $R/\overline{W}$ signal sets the output of gate U623a ($\overline{RD}$) low to activate the output of ROM U602. The microprocessor then reads the information from data bus lines D0 through D7.

8-51. Reading information from RAM U603.

To read information from RAM U603, the microprocessor:

- Sets the read/write ($R/\overline{W}$) output (U601, pin 32) high.
- Sets the address code of the memory location to be read onto address lines A0 through A12.
- Sets at least one of the following address lines, A6-A12, high in order to place the output of NOR gate U606c low ($\overline{RAM}$).
- Sets address lines A13, A14 and A15 low to enable NOR gate U606a. The combination of addresses A6-A15 required to enable the RAM effectively maps processor memory locations 40-1FFF into U603.

The positive portion of timing signal E+Q (U624a pin 3) and the high $R/\overline{W}$ signal pulses the output of gate U623a ($\overline{RD}$) low to enable the output of RAM U603. The microprocessor then reads the information from data bus lines D0 through D7.

8-52. Writing to the unprotected section of RAM U603.

To write to the unprotected section of RAM U603, the microprocessor:

- Sets the read/write ($R/\overline{W}$) output (U601, pin 32) low.
- Sets the address code, of the memory location where the information is to be stored, onto address lines A0 through A12. (*When addressing the unprotected section of U603, at least one of the address lines A9-A12 will be set high forcing the output of U608a high*).
- Sets address lines A13-A15 low to force the $\overline{RAM}$ output of decoder U606a high.

Since at least one of the address lines A9-A12 is high the output of U608a is forced high ($\overline{CALRAM}$). This output is inverted by inverter U634c forcing the input to AND gate U622b low. The low output of gate U622b is input to NOR gate U642c which causes the output of U642c to track its other input, the timing signal E+$\overline{Q}$. The low portion of the timing signal activates the input of RAM U603 through control line EN3 (RAM 603 pin 27). The microprocessor then writes the information to U603 through data lines D0 through D7.

8-53. Writing to the protected section of RAM U603.

The "Write to CAL-RAM" sequence begins with a **CAL** command, either from the interface bus or from the front panel. The microprocessor is reset prior to each calibration routine to insure that valid measurements are obtained.

Calibration Reset. Upon receiving the **CAL** command, the microprocessor stops toggling the $\overline{\text{OTL}}$ (U611 pin 19) signal and waits for the circuit to time out and reset as follows:

- A continually low (or high) $\overline{\text{OTL}}$ signal applied to capacitor C631 allows the input of inverter U633A to go low.

- The high output of U633A and the normally high $\overline{\text{RESET}}$ signal applied to the inputs of gate U633B cause its output to be held low, disabling the reset of counters U631, U632A and U632B.

- Counters U631, U632A and U632B count the 2 MHz clock signal applied to U631, pin 10. After counting for 524288 µsec. (from the last reset), the output of U632B pin 9 is set high.

- The high output of U632B pin 9 is applied to the minus input of comparator U636B causing its output to go low. The low output from U636B is applied to the plus input of comparator U636C causing its output to go low.

- The low output of U636C is coupled through inverter U634a and U634b to the $\overline{\text{RESET}}$ input (U601 pin 37) of the microprocessor; to gate U633b, which causes its output to go high and reset counters U631, U632a and U632b to zero; and to "flip-flop" U635b. Clearing U635b sets its $\overline{\text{Q}}$ output high to remove the low signal from the CLR input of U635a, pin 15.

CAL-RAM Lock circuit operation. The CAL-RAM Lock circuit protects the instrument's calibration constants by preventing accidental writing to the protected (calibration) section of RAM U603. To enable the write capability of the protected section of this RAM, memory locations 40 to 1FFF, requires that: 1) the correct address has been placed on the address lines and 2) the CAL-RAM lock circuit has been "unlocked " ($\overline{\text{NVE}}$ set low).

- After being reset, counters U631, U632 and U632b begin to count the 2 MHz clock signal applied to U631, pin 10.

- The output of counter U631 (pin 3) is set high 4096 µseconds after the circuit reset. This signal sets the "J" input of flip-flop U635a high, enables gate U633c, and insures that the output of gate U625c is kept low.

- The microprocessor sets address lines A4 and A5 high and line A3 low to select the $\overline{\text{CALREQ}}$ output of decoder U604.

- The timing signal E+Q (U604, pin 6) activates the $\overline{\text{CALREQ}}$ output of decoder U604. The $\overline{\text{CALREQ}}$ signal must occur between 4096 and 4100 µsec. after the circuit reset has occurred to be valid.

- The negative $\overline{\text{CALREQ}}$ pulse clocks the high "J" input into flip-flop U635a which sets output signal $\overline{\text{NVE}}$ low. The following section titled CAL-RAM Write Operation explains how this enables the write input of RAM U603.

If the $\overline{\text{CALREQ}}$ signal is applied to gate U633c while the 4096 usec. signal is low, the output of U633c will be set high, which resets flip-flop U635b. The low $\overline{\text{Q}}$ output of

U635b clears flip-flop U635a to "lock" the circuit. Also, if the 4096 usec. signal is low when the $\overline{\text{CALREQ}}$ signal is applied to the clock input of U635a, the $\overline{Q}$ output will remain high (locked).

CAL-RAM Write operation. Once the CAL-RAM Lock circuit has been "unlocked" ($\overline{\text{NVE}}$ set low), the microprocessor:

- Sets the address code of the memory location where the information is to be stored onto address lines A0 through A12. (*When writing to the protected section of U603, address lines A9-A12 will be set low.*)

Since $\overline{\text{NVE}}$ is forced low by the CAL-RAM Lock circuitry the output of AND gate U622b is forced low. The low output of gate U622b connects to NOR gate U624c causing the output of the gate be equal to the gate's other input, timing signal $E+\overline{Q}$. When the timing signal is in a low state, the input to the memory location specified by address A0-A12 is activated. The microprocessor then writes the information to U603 through data lines D0 through D7.

After completing the write to CAL-RAM, the microprocessor toggles the $\overline{\text{OTL}}$ signal at U611, pin 19. The positive $\overline{\text{OTL}}$ pulse is applied to gate U625d. The negative pulse from the output of U625d presets J-K flip-flop U635b, setting its $\overline{Q}$ output low. The low $\overline{Q}$ output from U635b resets J-K flip-flop U635a, setting its $\overline{Q}$ output high to remove the RAM write enable signal ($\overline{\text{NVE}}$) and "lock" the circuit. The $\overline{\text{OTL}}$ signal also resets counters U631, U632a and U632b.

The CAL-RAM Lock and CAL-RAM Write operations are performed a total of five times for each calibration command. However, the Calibration Reset operation is performed only once.

In summary there are two ways to enable the write function of U603, one used for writing to the unprotected section of RAM and the other for the protected section. When writing to the unprotected section of RAM, only the address of the memory location to be written to needs to be placed on the address bus. When writing to the unprotected section, the address needs to be on the address bus and the CAL-RAM lock circuit must be "unlocked".

8-54. Reset Circuit Operation

The purpose of the reset circuit is to set the microprocessor to a known state. The reset circuit is active under the following conditions:

- At "power-on".
- When the +5 volt power supply is low.
- If the microprocessor goes to a non-operational state.
- At the beginning of a calibration or auto calibration routine.

Power-on Reset. The power-on reset circuit consists of comparators U636a and U636c, inverters U634a and U634b and battery BT601.

The minus input of comparator U636a is referenced to +3 volts by battery BT601. The plus input of U636a is connected through a voltage divider to the +5 volt un-regulated power supply. At initial power-on, the plus input to U636a is less than the +3 volt reference on the minus input and the output is held low. The low output of U636a is applied to the plus input of U636c, holding its output low. The low output of U636c is coupled through inverters U634a and U634b to the $\overline{\text{RESET}}$ input of the microprocessor.

As the power supply reaches operating voltage, the voltage at the plus input of U636a exceeds the reference voltage at the minus input and the output goes positive. The positive output of U636a applied to the plus input of comparator U636c causes its output to go high. The high output of U636c is coupled through inverters U634a and U634b to the $\overline{\text{RESET}}$ input of the microprocessor to release it from the RESET state.

Low Power Reset. If the un-regulated +5 volt power supply should drop below approximately +7 volts, the plus input of comparator U636a drops below the +3 volt reference at the minus input causing the output to go low. The low output of U636a is applied to the plus input of U636c causing its output to go low. The low output of U636c is coupled through inverters U634a and U634b to the $\overline{\text{RESET}}$ input of the microprocessor. The processor is held in a RESET condition until the un-regulated +5 volt supply returns to normal.

Microprocessor Inoperative Reset. Under certain conditions it is possible for the microprocessor to "lock-up" or become non-operational. During normal operation, the microprocessor continually toggles the $\overline{\text{OTL}}$ signal at U611, pin 19. If the $\overline{\text{OTL}}$ fails to toggle, the processor is reset by the Watch Dog circuit as follows:

A continually high or low $\overline{\text{OTL}}$ signal applied to capacitor C631 allows the input of gate U633a to go low. The high output of U633a and the normally high $\overline{\text{RESET}}$ signal applied to the inputs of gate U633b cause its output to go low and reset counters U631, U632a and U632b. After being reset the counters begin counting the 2 MHz clock signal applied to U631, pin 10. After counting for slightly more than 0.5 seconds the output of counter U632b pin 9 is set high. The high output of U632b is applied to the minus input of comparator U636b causing its output to go low. The low output from U636b is applied to the plus input of comparator U636c causing its output to go low. The low output of U636c is coupled through inverters U634a and U634b to the $\overline{\text{RESET}}$ input of the microprocessor to reset it. The $\overline{\text{RESET}}$ signal from inverter U634b is also applied to gate U633b causing its output to go low and reset counters U631, U632a and U632b.

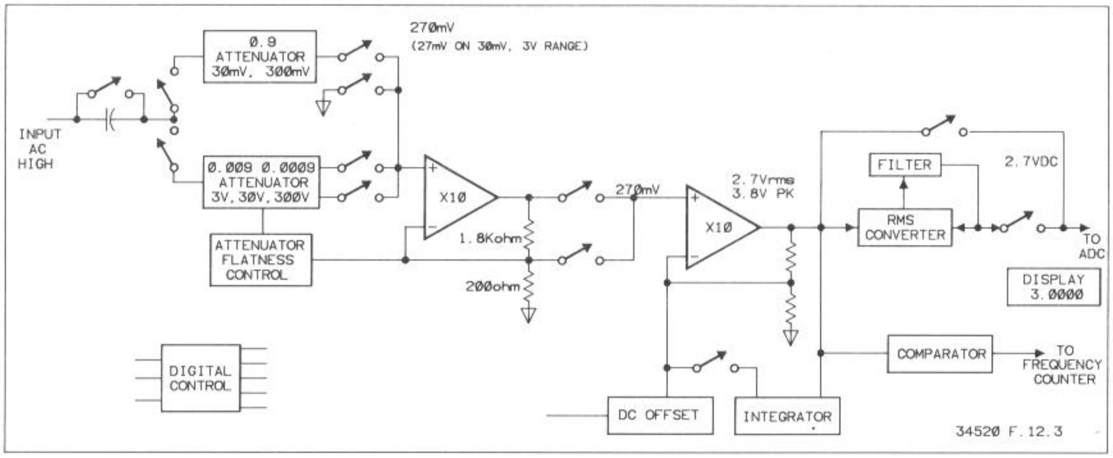
Calibration Reset. The microprocessor is reset prior to each calibration routine to insure that valid measurements are obtained. When calibration is requested, the microprocessor stops toggling the $\overline{\text{OTL}}$ signal at U611 pin 19, and waits for the circuit to time out as follows:

A continually high or low $\overline{\text{OTL}}$ signal applied to capacitor C631 allows the input of gate U633a to go low. The high output of U633a and the normally high $\overline{\text{RESET}}$ signal applied to the inputs of gate U633b cause its output to go low and reset counters U631, U632a and U632b. After being reset the counters begin counting the 2 MHz clock signal applied to U631, pin 10. After counting for slightly more than 0.5 seconds the output of counter U632b pin 9 is set high. The high output of U632b is applied to the minus input of comparator U636b causing its output to go low. The low output from U636b is applied to the plus input of comparator U636c causing its output to go low. The low output of U636c is coupled through inverters U634a and U634b to the $\overline{\text{RESET}}$ input of the microprocessor to reset it. The $\overline{\text{RESET}}$ signal from inverter U634b is also applied to gate U633b causing its output to go low and reset counters U631, U632a and U632b.

8-55. AC to DC Converter

The AC measurement functions are voltage, current, frequency and period. They can be used in either an AC coupled mode or a DC coupled mode. For AC current measurements, the input signal is routed through the same set of shunt resistors used for DC current measurements and the AC voltage drop across those resistors is measured. A simplified block diagram of the AC section is shown in Figure 8-3. Notice the circuitry contains two compensated attenuators, two X10 gain stages, an RMS converter, a filter and various control circuits. The AC to DC Converter can be separated and explained as follows:

A. Input Coupling
B. Attenuators
C. Amplifier Circuitry
D. RMS Converter
E. DC Offset Correction
F. Frequency Comparator
G. Auto Calibration



0.9
ATTENUATOR
30mV, 300mV
270mV
(27mV ON 30mV, 3V RANGE)
INPUT
AC
HIGH
0.009 0.0009
ATTENUATOR
3V, 30V, 300V
X10
1.8Kohm
200ohm
ATTENUATOR
FLATNESS
CONTROL
270mV
2.7Vrms
3.8V PK
X10
FILTER
2.7VDC
RMS
CONVERTER
TO
ADC
DISPLAY
3.0000
DIGITAL
CONTROL
COMPARATOR
TO
FREQUENCY
COUNTER
DC OFFSET
INTEGRATOR
34520 F.12.3

Figure 8-3. AC Assembly Block Diagram

Refer to schematic A3 for the following discussion.

8-56. Input Coupling

The AC input signal is routed to the AC to DC Converter assembly (A3) from the Input Signal Conditioning assembly (A2). AC or AC+DC input coupling is selected by relay A3K301. When the AC function is selected, the input signal is connected to range select relay A3K302 through capacitor A3C301. Capacitor A3C301 blocks the DC component of the input signal. When the AC+DC function is selected, the input signal is connected to range select relay A3K302 through relay A3K301 pins 3 - 5 thus bypassing C301. In this configuration, both the AC and DC components of the signal are coupled to the AC Converter input.

8-57. Attenuators

Two input attenuators are used to condition the input signal. Relay A3K302 switches the input signal to the selected attenuator and also grounds the input of the unused attenuator to maintain the proper impedance to the AC feedback circuit. The attenuator composed of resistors A3R302, R303, R304 and capacitors A3C302 and C303 is selected for the 30mV and 300mV ranges. The output signal from the 30mV/300mV divider is 90% of the input signal. The attenuator composed of resistors A3R305, R307, R308 and capacitors A3C305, C306, C307, C332 is selected for the 3V, 30V and 300V ranges. This attenuator reduces the input signal to 0.9% of its original value on the 3V and 30V ranges and to .09% on the 300V range.

The attenuated signal is connected to amplifier A3Q307, U302 by FET switches Q301-Q303. The signal for the 30mV and 300mV ranges is routed through FET switch A3Q303. The signal for the 3V and 30V ranges is routed through switch A3Q302 and the signal for the 300V range is routed through switch A3Q301.

Diodes A3CR307/CR311 and CR308/CR310 provide over voltage protection on the 30mV and 300mV ranges. Diodes CR306, CR309, CR310 and CR305, CR312, CR311 provide over voltage protection on the 3V and 30V ranges.

8-58. Amplifier Circuit

The AC Converter amplifier is a two stage amplifier whose purpose is to provide a 2.7 volt full scale input voltage to the RMS Converter for all full scale AC inputs. The active elements of the amplifier are FET A3Q307 and operational amplifiers A3U302 and A3U304. FET A3Q307 provides high input impedance to isolate the amplifier from the attenuators. Overall circuit gain, from the input of U302 to the output of U304 is X100 for the 30mV and 3V ranges and X10 for the 300mV, 30V and 300V ranges. To achieve an overall gain of 100, A3U302 amplifies the signal by 10, as determined by feedback resistors A3R328/R329. Analog switch A3U303 (pins 16 - 1) selects the output of amplifier A3U302 as the input to U304. U304 amplifies the signal by 10, as determined by resistors A3R332/R333. Therefore, the overall gain is 100. To achieve an overall gain of 10, analog switch A3U303 pins 16 - 1 open and 3 - 4 close. This selects an input signal for U304 from the junction of resistors A3R328/R329. This signal level is equivalent to the signal level at the input of U302 so the X10 gain of U302 has been nullified and the overall circuit gain is the X10 gain of U304. The output of U304 is connected to the input of RMS converter A3U305.

8-59. RMS Converter

The True RMS Converter output is a positive DC voltage with its value equal to the true rms value of the input. The RMS converter is a high performance integrated circuit which uses an implicit computational method to convert the AC signal to an equivalent DC voltage. The converter contains an absolute value converter (full-wave rectifier), a squarer-divider circuit, a low pass filter (integrator) and a precision current mirror.

AC measurement speed is limited by the RMS converter filter circuit. The circuit has been designed to allow two measurement speeds; AC Slow (ACS) and AC Fast (ACF) that are set by the command **ACBAND**. The AC Fast function permits faster reading rates but with reduced accuracy at low frequencies. AC Slow provides the greatest accuracy at low frequencies but at a reduced reading rate. This occurs because the filter reduces low frequency ripple and thus sets the lower cutoff point of our frequency range. The filter speed of the RMS converter is determined by capacitors A3C318 and A3C319. During AC Slow operation, switch A3U306 (pin 5 - 6) is closed to connect capacitor A3C319 in parallel with A3C318. When using the AC Fast function, switch A3U306 (pins 5 - 6) opens to remove A3C319 from the circuit.

The output of the RMS converter is connected, through switches A3U306 (pins 1 - 16) and A2U403 (pins 5 -6), to pin 40 of input hybrid A2U101. From this point on the measurement process is the same as a DC voltage measurement.

A3U309 is a comparator that will sense if U305 is outputting an over voltage level and shut down U305 at pin 5.

8-60. DC Offset Correction

When measuring using the ACV function, small input circuitry offsets occur and cause measurements errors. To reduce this error, the circuitry around U307 and U308 is used. When in the ACV function, U303 pin 5 - 6 are closed and 8 - 9 are open. U308 is configured as an integrator to measure the DC offset at the output of U304 and this offset correction is applied to the inverting input of U304. When using the ACDCV function, U303 pins 8 - 9 close and 5 - 6 open. When pins 8 - 9 close, R338 is switched in as the feedback resistor to reduce the gain of U308 to prevent feedback errors. Q309 is used to switch capacitor C320 into the circuit when the AC Normal function has been selected. Additional DC offset correction is discussed in a later paragraph titled Automatic Calibration.

8-61. Frequency Comparator

Comparator U310 is selected when the frequency or period function is selected. This directs the AC signal to the A2 Inguard Controller for measurement.

8-62. Automatic Calibration

When the Automatic Calibration function (**ACAL**) is selected, the AC converter is electronically calibrated to provide the greatest degree of accuracy by compensating for DC offsets and frequency response errors. This is done using the Auto-zero and Frequency Response Compensation circuitry described below.

Auto-zero

Auto-zero is performed at the beginning of each automatic calibration routine. During Auto-zero, the AC amplifier input is grounded by FET switch A3Q304. Any offset voltage from amplifier A3Q307/U302 is coupled through analog switch A3U303 to amplifier A3U304 which amplifies the offset error and adds any error U304 may have. The output of A3U304 is coupled through switches A3U306 (pins 3 - 4) and A2U403 (pins 5 - 6) to input hybrid A2U101. The error signal is measured and the results used by the inguard controller to set DAC A2U217. A2U217 controls the output of amplifier A2U218 which is then connected back to the AC board (A3). This signal is connected through buffer A3U307 to the minus input of amplifier A3U304 to cancel the offset voltage.

Frequency Response Compensation

Many voltmeters make AC measurements at frequencies up to 100kHz but this voltmeter makes measurements to 1MHz. To achieve this, compensated RC attenuators are used. At low frequencies the attenuators are resistive dividers, while at high frequencies they act as capacitive dividers. To equalize the high frequency and low frequency responses of such an attenuator, a manual adjustment of one of the capacitance elements is often used. In this instrument, that adjustment is performed electronically with the use of the "**ACAL**" function. By adding a third capacitor to the attenuator and driving it with a scaled value of the input signal, the capacitive attenuator can be controlled so that a flat frequency response is produced. The signal fed back to the capacitor is controlled by a DAC (digital to analog converter) operated as a variable attenuator. A simplified block diagram is shown in Figure 8-4. A more detailed discussion follows.

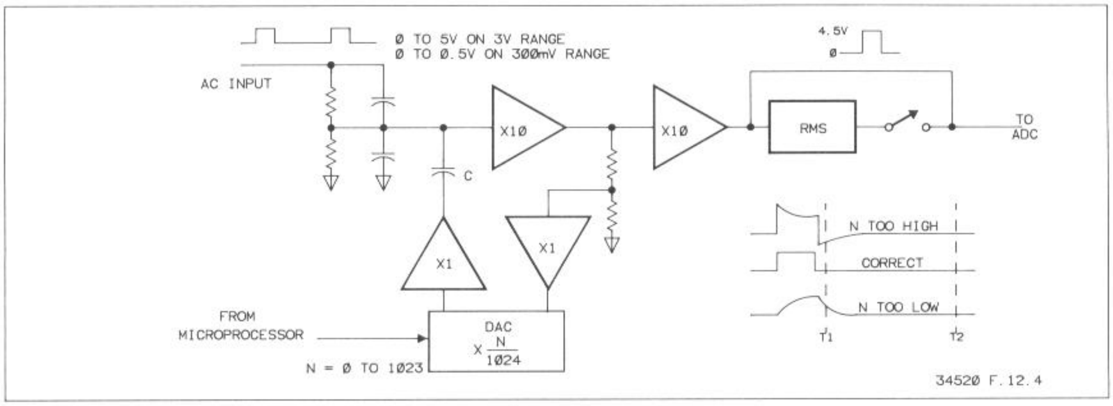


Figure 8-4. Attenuator Compensation

There are two separate compensated input attenuators used in the AC section. One is used for the 30mV and 300mV ranges and the other is used for the 3V, 30V and 300V ranges. The attenuators are each automatically compensated by the **ACAL** function.

During **ACAL**, a 0.5 volt and a 5.0 volt pulse signal are generated by the AC Autocal circuit A2U402 located on the A2 Input Signal Conditioning assembly. These values are determined by resistive divider A2R301 and R302. Switch A2U402 is used to select the desired voltage level.

These pulse signals are applied to the input attenuators of the AC board (A3) and measurements are made to determine the flatness of the signal. The first measurement is made shortly after the falling edge of the pulse signal and a second is made at a later time. The first measurement will determine the amount of the overshoot or undershoot (see T1 on Figure 8-4). The second measurement (made at T2 on Figure 8-4) will be the reference level to which the first measurement is adjusted. These measurements are then nulled via the circuit composed of DAC U311 and the capacitors C304 or C308. These capacitors shunt their respective attenuators. Their values are effectively varied from 0 to 1 times their value in 1024 steps by the control lines to DAC U311.

As previously stated, the values of C304 and C308 are being changed, thus a variable capacitor is electronically simulated. This is done by monitoring the output of A3U302 with A3U301 pin 5. A3U301 is a buffer whose output goes to DAC U311. The DAC is not configured as typically seen but is driven in a voltage mode and pin 15 of the DAC becomes the input signal to U301. The level of this signal will vary and is dependent on the amount of compensation required. The gain of U301 is selected by the combination of U313, Q305 and Q306. For all ranges except the 300V range, Q305 is on and this sets the gain of U301 to X1. On the 300V range, Q306 is on and this sets the gain of U301 to X10. The gain is set to X10 for the 300V range because the input to amplifier Q307/U302 is taken from the junction of R307/R308 and this signal level is a factor of 10 less than the signal at the junction of R305/R307. The output of U301 to C304 and C308 is used to effectively vary the value of the capacitance to provide frequency compensation.

DAC U311 controls the amount of feedback to capacitors C304 and C308. The amount of feedback is calculated during Autocal, retained in memory and this correction value is used to control DAC U311 during each measurement. The DAC receives it control instructions via data lines, D0 -D9.

It should be noted the auto calibration range is limited; therefore, variable capacitor C332 was included in the attenuator to serve as a course center adjustment. Normally this will not require adjustment after leaving the factory; however, a calibration procedure is given in this manual.

8-63. 44491A General Purpose Relay Card

Refer to the 44491A schematic for the following discussion.

The General Purpose Relay Card can be used for four functions; 1) to multiplex signals to the high and low inputs of the multimeter, 2) to multiplex signals to the amps input of the multimeter (to measure current), 3) to multiplex signals to an external device through the cards common terminals, or 4) to act as an actuator.

For the purpose of explanation the card's circuitry will be divided into three functional areas; 1) control circuitry, 2) drive circuitry, and 3) contact circuitry.

8-64. Control Circuitry

Controlling the position of each relay are the outputs of shift registers U801 and U802. These shift registers convert a 16 bit serial data string sent from the instrument's inguard controller, A2U501, into a 16 bit parallel output. The parallel outputs are connected to drive transistors U803 and U804 and gates U806 and U807.

The gates U806 and U807 are used to control the output of inverters. U805a-U805g. These gates are used to prevent the outputs of both an active high transistor and an active low inverter, which are attached to the same point, from being turned on at the same time.

To identify the card as option 44491A pin 6 of connector P801 is tied to ground. This signal line is used by the inguard processor as an ID line.

8-65. Drive Circuitry

A matrix scheme of row and column drivers is used to control the configuration of the card's relays. The drivers are broken up in the following manner.

Two Rows:
  Row 1- U805a and U803d (K800, 1, 2, 3 and 9)
  Row 2- U805b and U803c (K805, 6, 7, 8 and 4)
Five Columns:
  Column 1- U805c and U803b (K800 and K805)
  Column 2- U805d and U804a (K801 and K806)
  Column 3- U805e and U804d (K802 and K808)
  Column 4- U805f and U804c (K803 and K807)
  Column 5- U805g and U804b (K804 and K809)

The output of the row drivers are either driven high (+5V) by a transistor being turned on, driven low (ground) by a low output of an inverter, or left floating which occurs when transistors are turned off or when the inverter has a high output. Column drivers have both transistors and inverters tied to the same point causing the outputs to always be driven high or low.

To open or close a relay requires that one column driver work in conjunction with a row driver. For instance to set relay K800 requires that column 1 be driven high while row 1 is driven low. To reset

K800 column 1 must be driven low while row 1 is driven high.

8-66. Contact Circuitry

Two types of relays are used in the 44491A. The first type consists of relays K800-K803 and K806-K809 which have four normally open contacts. These relays are used as channel relays and always have all four contacts in the same position. A set position exists for these relays when all four contacts are closed and a reset position when all contacts are open.

The other type of relay used consists of K804 and K805 which have two contacts normally open and two contacts normally closed. These relays are used as tree relays and when in the set position have contacts between pins 10-11 and 4-5 closed and contacts between pins 2-3 and 8-9 open. In the reset position, contacts are in the opposite configuration with contacts 10-11 and 4-5 open and contacts 2-3 and 4-5 closed.

Channel relays K800-K803 along with tree relay K804 create the eight two wire channels 0-7. When K804 is set channels 0-3 are selected and when K804 is reset channels 4-7 are selected.

Channel relays K800-K803 along with tree relays K804 and K805 create the 4 four wire channels 10-13. Both K804 and K805 are always set when making a four wire measurement through channels 10-13.

Relays K808 and K809 are active when channels 8 and 9 are used as actuator channels. When a CLOSE command is executed to these channels either K808 or K809 is latched in a set position connecting the high and low input together.

Relays K806 and K807 are active when channels 8 and 9 are used to measure current. However, a relay protection scheme complicates operation of these relays.

When channel 8 has been selected to measure current with a CHAN or SLIST command the following sequence of events occur:

- Relay K808 is closed which connects the high and low input together.
- Relay K806 is closed connecting the instrument's AMPS and LO terminals to the high and low inputs.
- Relay K808 is opened, removing the short from across the input and causing the input current to be forced into the AMPS terminal.

K808 is used as a current shunt in this sequence so that at the time relay K806 is closed there is no potential across the contacts. This protects K806 from arcing, thereby, preserving the contacts.

When the channel is later opened the following sequence of events occur:

- Relay K808 is closed.
- Relay K806 is open.
- Relay K808 is open.

Again K808 is used as a current shunt so that when K806 is open there is virtually no potential across the contacts. Preservation of K806's and K807's contacts is important because low contact resistance is required to make accurate current measurements.

8-67. Operation of Channel 0

An explanation of the operation of channel 0 is given below. Circuitry used to control channels 1-7 operates in an identical manner to the control circuitry for channel 0.

Closing channel 0 requires both relay K800 and K804 be configured in the set position. To configure K800 in the set position, row 1 must be driven low and column 1 driven high for approximately 10 milliseconds. This will occur as the result of Q4, Q6 and Q8 pulsing low. These three outputs cause the following events to occur:

- Transistor U803b is turned on driving column 1 high (this transistor will act as a current source).

- The output of gate U806c is forced low which subsequently causes the output of inverter U805c to be driven high (open).

The output of gate U806b is forced low which subsequently causes the output of inverter U805b to be driven high (Row 2).

- Since all other outputs of U801 and U802 are high, all other column drivers (U805d-U805g and U804a-U804d) and row driver 1 (U805a) are driven low.

As a result of these logic states, transistor U803b sources current through the set coil of relay K800 to the associated logic ground created by the low output of inverter U805a. Current flowing through the relay coil creates an electromagnetic field which causes K800's to latched in a closed (set) position.

After K800 has been latched closed, the shift register will output new data to latch K804 in its set position. This is done by driving column 5 high and row 2 low as a result of U802 outputs Q1, Q5 and Q6 being low.

Since the relays used on this relay card are latching relays, an active circuit is required to change the position of the contacts (open or close). Resetting K800 requires that row 1 be driven high while column 1 is driven low for approximately 10 milliseconds. Circuit operation to latch relay contacts work similar to what was described earlier for latching the contacts closed.

8-68. Card Configuration

Holes are left in the circuit board to allow for users to easily configure different channels to fit their application. Components on the schematic that are have a label with the letters UC are not mounted at the factory. These "User Configurable" components only indicate mounting holes.

Channels 4-7 have positions to mount RC or RL filters on the inputs. To create an RC filter the selected resistor should be put in place of JM801-JM804 and the selected capacitor in UC809-812.

Channels 8 and 9 have positions to mount contact protection circuitry. A general contact protection circuit might consist of a jumper in position UC805-UC806, a resistor in position UC807-UC808, a capacitor in UC803-UC804 and a metal oxide varistor in position UC801-UC802.

To configure the COMmon terminals of the card, jumper wire needs to be placed in position UC813 and UC814. This will connect channels 0-7 to the COM terminals whenever these channels are connected to the instrument.

8-69. 44492A 10 Channel Reed Multiplexer

Refer to the 44492A schematic for the following discussion.

The 10 Channel Reed Multiplexer is used to connect one of ten channels to the input of the 3457A's high and low terminals. The 44492A can be the instrument's input source for DC voltage, AC voltage, AC+DC voltage, resistance, frequency and period measurements. Current and 4-wire resistance measurements cannot be made through the 44492A.

To identify the card as option 44492A pin 6 of connector P851 is tied to the +5 volt power supply. This signal is used by the instrument's inguard processor as an ID line.

8-70. Closing a Channel

To close a channel the instrument's inguard controller (A2U501) sends 16 bits of configuration data to shift register U851 at pin 2. Shift register U851 stores the last 8 bits of the configuration string while the first 8 bits are shifted into register U852. After all 16 bits are clocked, the output of the shift register is enabled by a strobe pulse initiated by the inguard controller.

Outputs of shift registers U851 and U852 are normally high and active when low. Outputs of the registers drive the base of transistors U853-U855. When the base of the transistors are driven low, the transistors are turned on and are used to source current across relay coils. An example of how to close channel 0 is given below.

- A serial string of 15 low states followed by one high state is clocked into U851 and U852.
- The strobe input of the shift registers (pin 1 of U851 and U852) is driven high.
- Output Q1 of shift register U851 is low while all other outputs remain high.
- The low Q1 output applied to transistor U854 pin 13 causes the transistor to turn on and act as a current source.
- Current flows from the emitter of U854 through the coil of K851 to ground. This current causes an electromagnetic field that force the contacts of K851 closed.

All ten relays used on this card are reed relays. These relays must have current applied across their coils for the contacts to be closed. As soon as the current is removed the relays begin to open.

Resistors R861 and R862 combine with inductors L851 and L852 to limit surge currents. Surge currents result from inputs with varying potentials being switched to the instrument. By lowering these surge currents relay life is extended.

8-71. TROUBLESHOOTING

This information will assist in isolating the failure to the component level on the HP 3457A multimeter module. The information provided assumes a problem was indicated by either the power-on or operation verification tests.

8-72. General Information

Other than the normal operating configurations, this DMM provides three special configurations. These are the Self Test, Diagnostic and Autocal modes.

The Self Test mode is designed to provide confidence testing of the instrument. It is a progressive test of both analog and digital hardware that gives better than 90% confidence of proper hardware operation. Through interpretation of the self test failure results, most instrument failures can be isolated to small functional blocks where more traditional troubleshooting techniques can be used to isolate the failed component.

Diagnostic operation is a subset of self test operation. There are two internal mechanical adjustments performed by using diagnostics called Diagnostic 4 and Diagnostic 8. Diagnostic 4 is discussed in the Input Amplifier Offset Adjustment procedure in section 5 and Diagnostic 8 is discussed in the AC Convertor Frequency Response Adjustment procedure. There are also 3 other diagnostics that are subsets of self tests 1, 2 and 3. They will be discussed in the Self Test paragraphs in this section.

In the Autocal (ACAL) mode, two 10 bit D to A Converters (DAC's) are used in the DMM for correction of instrument error sources. One DAC is general purpose and is used to supply DC correction voltages to various circuits. The other DAC performs the specialized function of high frequency compensation of the two AC input attenuator circuits. There are six different correction constants generated when a full Autocal (ACAL) is executed. Three DC constants are produced along with two AC attenuator correction constants. In addition, the internal 10M ohm divider is measured for future use during ohms measurements above 30M ohms.

8-73. A1 Assembly Failure Indications

If the front panel display remains blank or contains some unintelligible messages and appears to be "locked up" after the instrument is "turned on", the fault is probably located on the A1 assembly (03457-66501). For this condition, refer to the Self Test information in this section (especially tests 0, 1 and 2). If the display is blank, the power cord, fuse and line select switches should be checked to be certain the instrument is receiving power. Connectors A1-J501, A1-J701 and A1-J702 should be checked to be sure they are properly and securely connected. If you have a 03457-66511 assembly, refer to section 8-78 for more information.

If the instrument works properly from the front panel but fails to communicate over the HP-IB, the problem is due to a faulty A1 assembly. Be certain the interface cable is good and that it is securely connected between the HP 3457A and the controller when testing HP-IB communications.

If the display reads FAILED after the instrument is "turned on" or after a self test, refer to the Self Test information in this section.

8-74. A2/A3 Assembly Failure Indications

Failures in these assemblies can usually be detected by running the TEST routine. A failure will be indicated by a display of TEST FAILED and the error annunciator flashing. If this occurs, refer to the Self Test information in this section.

8-75. Self Tests

There are two categories of self tests that can be performed on the DMM assembly. These are the power-on self test and a keyboard executable self test. When power is applied, a Power-on Self Test is performed. The Power-on Self Test is an abbreviated version of the Self Test executed with the TEST command.

Satisfactory completion of the self test routine is indicated by a display message of SELF TEST OK. If an error is detected, the display message will be TEST FAILED and the front panel ERR annunciator will flash. This indicates the **ERR?** register contains a nonzero value. If the **ERR?** command returns a value of one (1) there is a hardware error (see **ERR?** command in Command Reference Section of HP 3457A Operating Manual). Another method of determining the failure mode is to read the ERROR register (*Press the Blue SHIFT key then the ERROR key*). If there is a hardware error, examine the AUXERR register by executing the command **AUXERR?**. A number will be displayed that indicates the specific test(s) that failed. This number corresponds to self test failure information in Table 8-2. If, for example, the number 32 is displayed on the control panel when the **AUXERR?** command is executed, Table 8-2 shows that AUXERR 32 corresponds to a Current Source, Gain Selection, Input Divider failure. If more than one test fails, the AUXERR numbers will be summed together. For example; if the Front end zero measurement test and the AC attenuator flatness test failed, the AUXERR number displayed would be 272 (256 + 16). For troubleshooting purposes, the lowest numbered AUXERR failures should be repaired first. Left of the AUXERR#, in Table 8-2, is a TEST#. This TEST# corresponds to the test descriptions provided in the Self Test (TEST) paragraphs in this section.

Table 8-2. Self Test Failure Information

TEST#	AUXERR#	FAILURE DESCRIPTION
N/A	1	Isolation error in normal operation (not during self test)
1	2	A/D controller self test error
2	4	Isolation self test error
3	8	Integrator convergence error
4	16	Front end zero offset error
5	32	Current source, gain select or input divider error
6	64	Amps function error
7	128	AC amplifier DC offset error
8	256	AC attenuator flatness error
9	512	Ohms precharge circuit error
0	1024	U502 ROM checksum error
0	2048	U503 ROM checksum error
0	4096	Nonvolatile RAM (U511) failure
0	8192	Volatile RAM (U506) failure
0	16384	Calibration Ram (U511) or RAM protection circuit error

* For instruments S.N. 2538A02954 and above see Table 8-3.

8-76. Power-on Self Test

At instrument power-on, an abbreviated form of the complete Self Test procedure is executed to check the fundamental digital hardware kernel and the communication link between the Main Controller (A1U501) and A/D Controller (A2U501). This consists of executing Self Tests 0, 1 and 2 in that order. These 3 tests are discussed in detail in the following Self Test paragraphs.

Upon satisfactory completion of the power-on test routine, the instrument momentarily displays the HP-IB address it is currently set to (the address is set to decimal 22 at the factory), emits a single "beep" and sets itself to the predefined power-on state. The front panel indications of this state are; the DC Voltage function, Auto-Range and automatic trigger are selected. For a complete list of power-on conditions, refer to Section III, Table 3-1 in this manual.

8-77. Self Test (TEST)

In addition to the 3 Power-on Self Tests, 7 other self tests may be executed by using the **TEST** command. All self tests are executed sequentially when the **TEST** command is executed and cannot be executed individually; however, the self tests are separated and numbered below to aid in troubleshooting.

Test 0 checks much of the circuitry on the Main Controller assembly A1. There are 5 subtests included in Test 0 and they are executed in the following sequence: 1) U502 ROM Checksum, 2) U503 ROM Checksum, 3) Nonvolatile RAM (U511), 4) Volatile RAM (U506), and 5) Calibration RAM (U511) and RAM write protection circuitry. These are also checked as part of the power-on test.

The ROM checksum tests against hard coded results. If the checksum of U502 is incorrect, executing the **AUXERR?** command will return a value of 1024. If the checksum of U503 is incorrect, executing the **AUXERR?** command will return a value of 2048. During the nonvolatile RAM test, FF, 55, 00 is written to each RAM location and read back (data presently in RAM is preserved). If the nonvolatile RAM test fails, the **AUXERR?** command would return 4096. The test on the volatile RAM is the same as the test on the nonvolatile RAM; however, the **AUXERR?** command would return 8192. The last part of test 0 writes to the protected portion of the nonvolatile RAM and reads back. If the information written is read back, this indicates the RAM is not protected. In this case the **AUXERR?** command would return the value 16384.

Test 1 checks the A/D Controller (A2U501) reset procedure, RAM and ROM. Reset occurs primarily at power-on; however, Main Controller (A1U501) can force an A/D Controller hard reset by sending continuous 0 bytes across the communications link (A2U509/U510) for greater than 10mS. While checking the A/D Controller RAM and ROM, the A/D Controller performs the tests described below while the Main Controller (A1U501) checks the reported results against hard coded limits.

1. The A/D Controller RAM Test writes 55, 00 to each RAM location and reads it back. A RAM test failure will force the reported ROM checksum result to be in error. On failure, the **AUXERR?** command will return the value 2.

2. The A/D Controller ROM Test performs a checksum on the ROM and transmits the results to Main Controller A1U501. On failure, the **AUXERR?** command will return the value 2.

A subset of self test 1 is diagnostic 1 which will cause the A/D Controller to continually loop through the Test 1 routine. Executing **DIAGNOSTIC 1** allows monitoring of signals while troubleshooting.

Test 2 is a cross-isolation data communications test that transmits data between the Main Controller (A1U501) and the A/D Controller (A2U501) through opto-isolators A2U509/U510. The Main Controller will transmit a sequence of codes to the A/D Controller which will "ECHO BACK" these transmissions, as it receives them, to the Main Controller. The data returned to the Main Controller is then checked for accuracy. If the Main Controller finds an error in the returned data, the error annunciator will flash and executing the **AUXERR?** command will return a value of 4.

During this procedure, the Main Controller will wait for a response from the A/D Controller. If the Main Controller never receives a response from the A/D Controller then it will fall into diagnostic 2 and the display will indicate "FAILED".

The data is transmitted in 11 bit frames consisting of one start bit, 8 data bits, one parity bit and one stop bit. The data is decremented from decimal 16 to decimal 1, with each of the patterns being independently checked for errors. The A/D Controller remains in the "ECHO BACK" mode until it receives a decimal 0 data byte. At that time it will execute its 'soft reset' routine. This will set the A/D Controller to its operational state where it will wait for the Main Controller to direct further activity.

A subset of self test 2 is diagnostic 2 which continuously sends only 4 distinct bytes, FF, OF, 55 and 01 between the A/D Controller and the Main Controller for troubleshooting purposes.

Test 3 is the integrator convergence test on assembly A2/2. This checks the ability of the A/D integrator (A2U512 and associated circuitry) to run-up from its reference current and then perform the normal run-down and achieve the predicted result. The Main Controller (A1U501) configures the isolated analog hardware (A2U501, A2U101, etc) for 3 volts DC and .0005 power line cycles integration time, sends the last cal constants generated and opens the input terminal within the A/D hybrid (A2U511) at pin 25.

The A/D Controller (A2U501) initiates a 10uS run-up using a known current, generated by A/D Hybrid U511, for a known period of time so the result is predictable. Run-down is executed, results are calculated and corrected using the last cal constants and the value is passed to the Main Controller for error checking against the expected results. Figure 8-5 illustrates some of the circuitry used in this test.

On error, if the **AUXERR?** command is executed, the number 8 will be displayed on the control panel if their are no other errors. This indicates an 'Integrator Convergence Error' (See Table 8-2).

A subset of test 3 is diagnostic 3 which causes the controller to continually loop through Test 3. Executing **DIAGNOSTIC 3** allows monitoring of signals while troubleshooting.

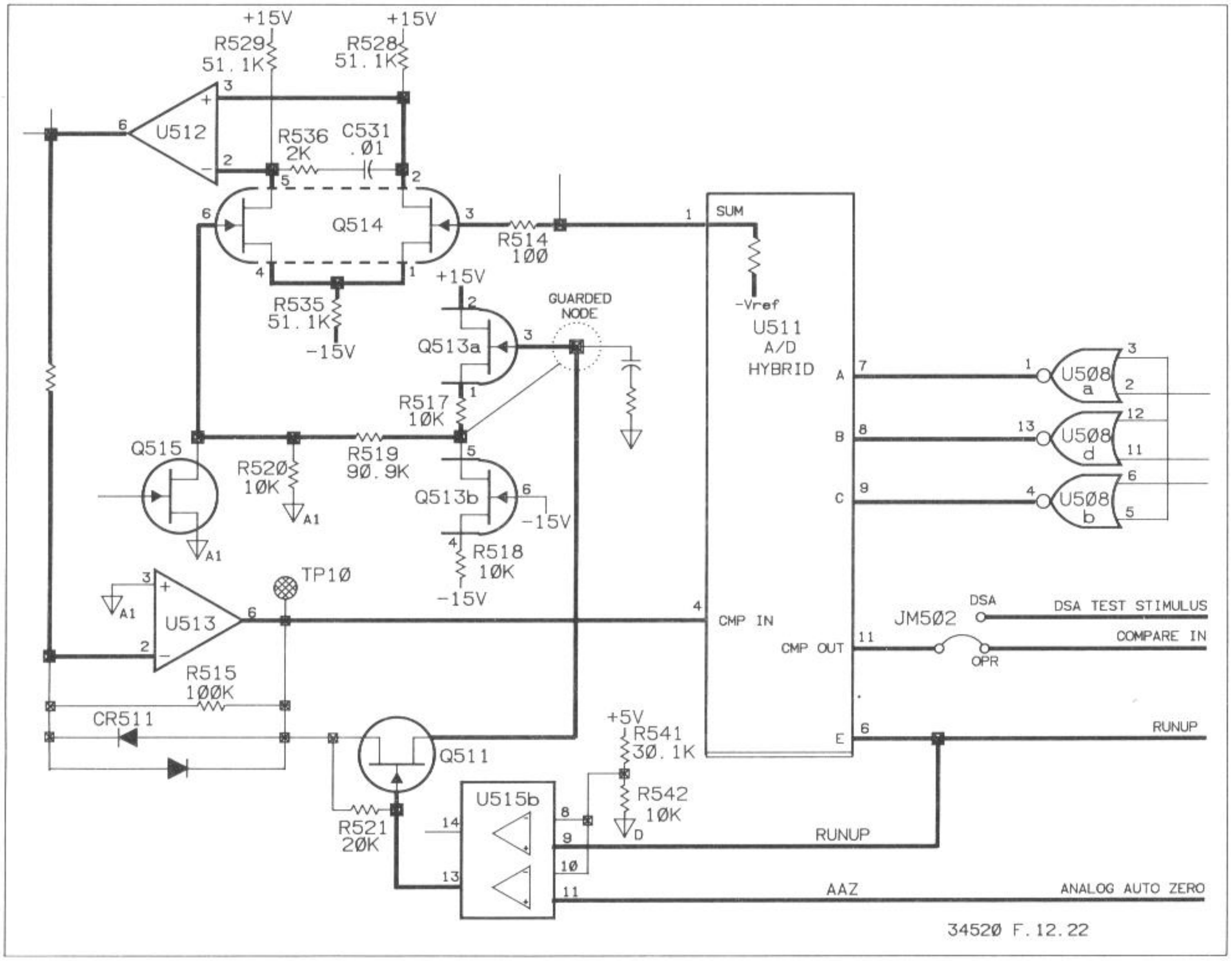

+15V
+15V
R529
51.1K
R528
51.1K
U512
R536
2K
C531
.01
Q514
R514
100
R535
51.1K
-15V
+15V
GUARDED NODE
Q513a
R517
10K
Q515
R520
10K
R519
90.9K
Q513b
-15V
R518
10K
-15V
TP10
U513
R515
100K
CR511
Q511
U515b
R521
20K
+5V
R541
30.1K
R542
10K
SUM
-Vref
U511
A/D
HYBRID
A
B
C
CMP IN
CMP OUT
E
U508 a
U508 d
U508 b
JM502
DSA
OPR
DSA TEST STIMULUS
COMPARE IN
RUNUP
RUNUP
AAZ
ANALOG AUTO ZERO
34520 F.12.22

Figure 8-5. Integrator Convergence Circuitry

Test 4 is the front-end zero offset test on assembly A2/1. This test measures the input amplifier (Q111, Q112, U111) input offset voltage and sends the result to the Main Controller (A1U501) for error checking. This test does not require any previous instrument calibration.

The Main Controller configures the isolated section (A2U501) for 0.03 volts DC with 1.0 power line cycle of integration time. An offset measurement is made on the 30mV range (gain = 333) through A2U101 switch MC followed by a measurement on the 3V range (gain = 3.33) through switch MC. This yields a result that is the input offset multiplied by 330. This result is scaled for the 30mV range using the latest cal constants. The Main Controller checks that the result is within the limits of 0 ±1.5mV. Figure 8-6 illustrates some of the circuitry used for this test.

On error, if the **AUXERR?** command is executed, the number 16 will be displayed on the control panel if their are no other errors (See Table 8-2). If this error occurs, an internal mechanical adjustment may correct the error. To perform the adjustment, execute **DIAGNOSTIC 4** and adjust the input amplifier offset adjustment (A2R113). Refer to the Input Amplifier Offset Procedure in section 5 for details. If adjustment does not correct the error, **DIAGNOSTIC 4** can also be used for troubleshooting because it puts this test into a looping condition so signals may be verified.

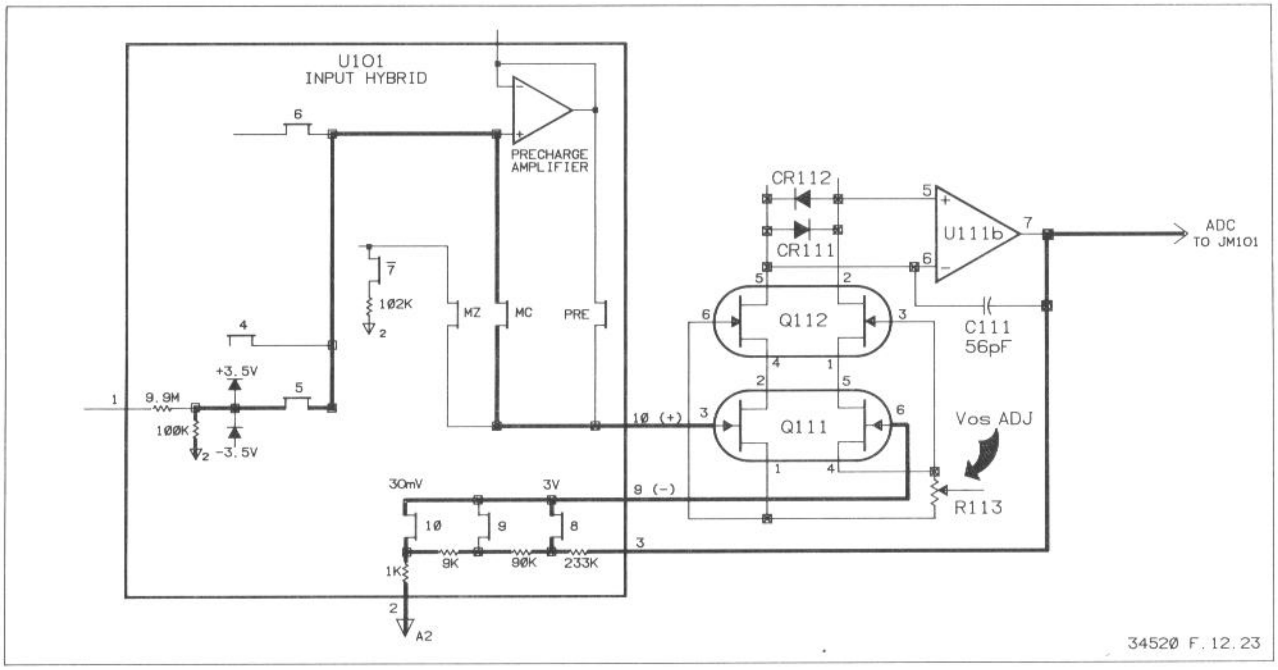

U1O1
INPUT HYBRID
6
PRECHARGE
AMPLIFIER
7
102K
2
MZ
MC
PRE
4
+3.5V
5
1
9.9M
100K
2
-3.5V
30mV
3V
10
9
8
9K
90K
233K
1K
2
A2
10 (+)
9 (-)
3
CR112
CR111
U111b
5
6
7
ADC
TO JM101
5
2
6
Q112
3
4
1
2
5
3
Q111
6
1
4
C111
56pF
Vos ADJ
R113
34520 F.12.23

Figure 8-6. Front-End Offset Circuitry

Test 5 checks the current source, gain select and input divider circuitry on assembly A2/1. The Main Controller (A1U501) initially configures the measurement section for 3 volts DC, 10 power line cycles integration time with the fixed input impedance on. The configuration is changed to the 30V and 300V ranges for later stages of the test.

The test consists of applying the 100nA ohms current source to the DCV front-end which is set for 10M ohm input impedance (**FIXEDZ ON**). A/D Controller, A2U101 sets the ohms current source to 100nA and closes K201. This applies the 100nA to the 10M ohm input impedance at U101 pin 1 through K107 thus yielding approximately 1 volt as an effective input to the DCV front-end. This 1 volt is first measured on the 3V range at U101 pin 13. Next the 30V range is selected which changes the input amplifier gain and turns on U101 switch 5 which provides a lower level signal to the input amplifier. After the 30V range is measured, the 300V range is selected. This changes the input amplifier gain and another measurement is taken. Figure 8-7 illustrates some of the circuitry used for this test.

The results are sent to the Main Controller for error checking. If a failure is detected and the **AUXERR?** command is executed, the number 32 will be displayed on the control panel if their are no other errors (See Table 8-2).

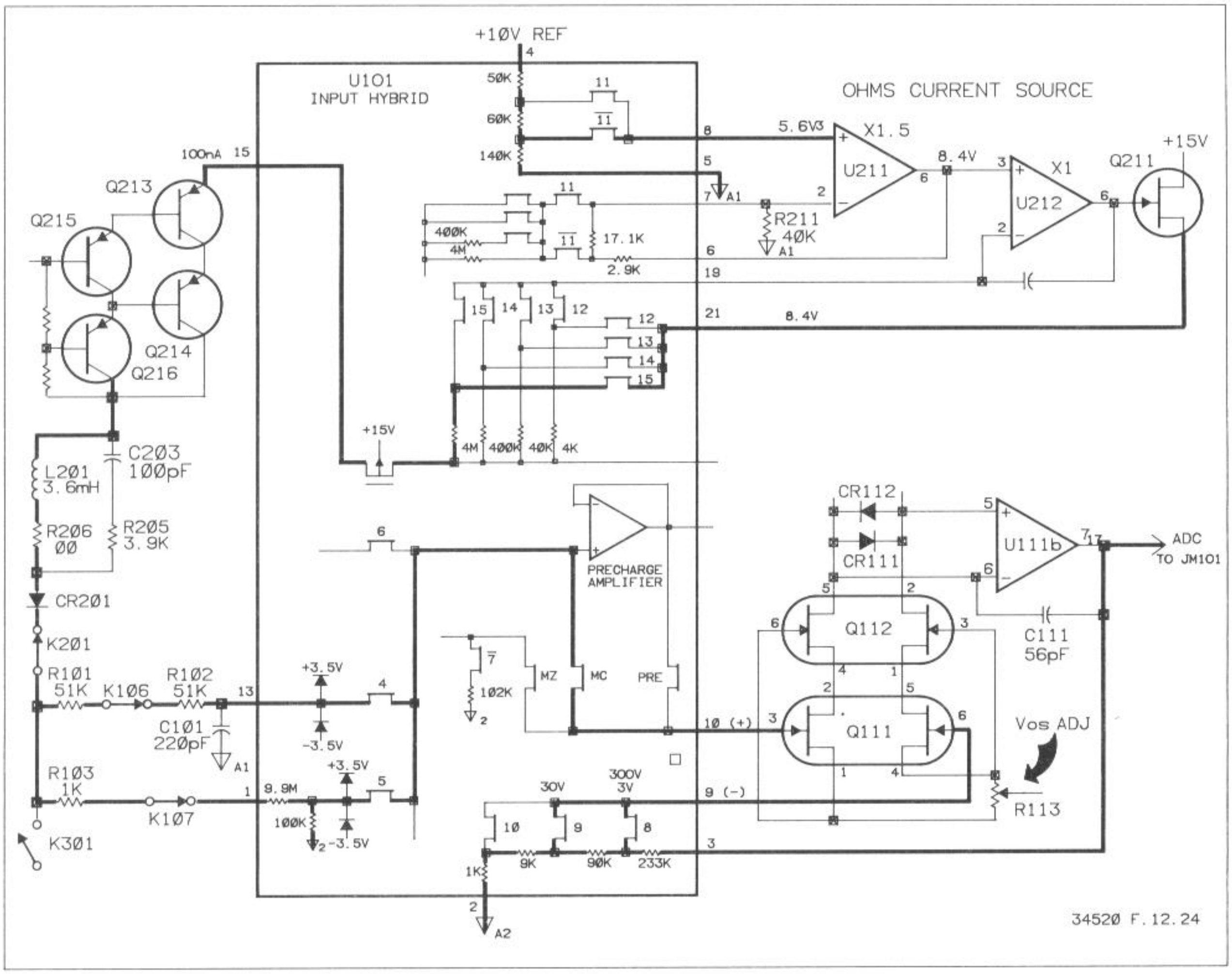

+10V REF
U101
INPUT HYBRID
OHMS CURRENT SOURCE
50K
60K
140K
5.6V
X1.5
U211
8.4V
X1
U212
Q211
+15V
R211
40K
A1
400K
4M
17.1K
2.9K
100nA
Q213
Q215
Q214
Q216
C203
100pF
L201
3.6mH
R206
00
R205
3.9K
CR201
K201
R101
51K
K106
R102
51K
C101
220pF
R103
1K
K107
K301
9.9M
100K
+3.5V
-3.5V
+15V
4M
400K
40K
4K
PRECHARGE AMPLIFIER
MZ
MC
PRE
102K
30V
300V
3V
9K
90K
233K
1K
A2
CR112
CR111
U111b
ADC
TO JM101
C111
56pF
Q112
Q111
Vos ADJ
R113
10 (+)
9 (-)
34520 F.12.24

Figure 8-7. Current Source, Gain Select and Divider Circuitry

Test 6 checks the operation of the amps function voltage sensing on assembly A2/1. It does this by applying 1mA from the ohms current source to A2R401 (corresponds to 1.5 amp range) and making a normal current measurement. The Main Controller (A1U501) configures the measurement section for the 3.0 amp DC current function, 10 power line cycle integration time with the fixed input impedance mode off. A/D Controller, A2U501 then configures the ohms current source for 1mA and switches on K201, K301 and K302. This routes the 1mA current through U402 S3 and K402 (pins 13 - 11) to the 0.1 ohm shunt (R401). The voltage across R401 is sensed at input hybrid U101 pin 40 by closing U403 S1 and S2. A normal DC current measurement is made and the result is sent to the Main Controller for error checking to 1mA ±500uA. Figure 8-8 illustrates some of the circuitry used for this test. If a failure is detected and the **AUXERR?** command is executed, the number 64 will be displayed on the control panel if their are no other errors (See Table 8-2).

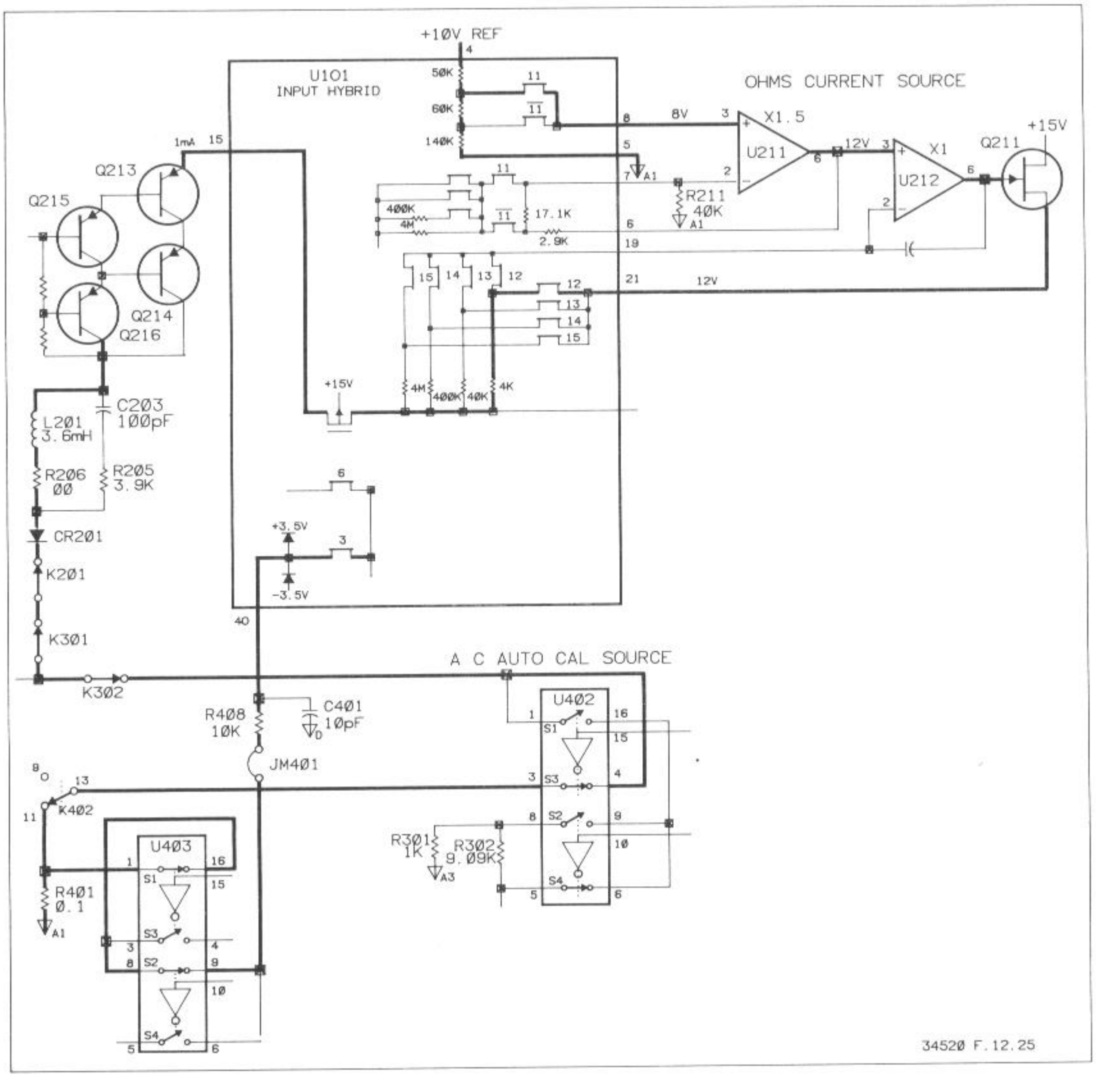

+10V REF
U101
INPUT HYBRID
50K
60K
140K
11
11
1mA
15
Q213
Q215
Q214
Q216
400K
4M
17.1K
2.9K
15
14
13
12
12
13
14
15
+15V
4M
400K
40K
4K
C203
100pF
L201
3.6mH
R206
00
R205
3.9K
CR201
K201
K301
K302
6
3
+3.5V
-3.5V
40
OHMS CURRENT SOURCE
8
5
7
A1
6
19
21
8V
X1.5
U211
R211
40K
12V
X1
U212
Q211
+15V
A C AUTO CAL SOURCE
U402
S1
S2
S3
S4
R408
10K
C401
10pF
JM401
K402
U403
R401
0.1
R301
1K
R302
9.09K
A3
34520 F.12.25

Figure 8-8. Amps Sense Circuitry

Test 7 tests the DC Offset voltage of the amplifier circuitry on assembly A3 to determine if it's within the proper limits. The amplifier being tested consists of A3U302, A3U304 and A3Q307. During testing, the AC amplifier input is grounded by FET switch A3Q304. Any offset voltage from A3Q307 and A3U302 is coupled through analog switch A3U303 to amplifier A3U304 which amplifies the error and adds any it may have. The output of A3U304 is coupled through switches A3U306 (pins 3 - 4) and A2U403 (pins 5 - 6) to input hybrid A2U101. The Offset DAC (A2U217) on assembly A2/1 is providing offset compensation back to the amplifier on the AC assembly through A3U307. The 300V range is selected to set the overall gain from A3Q307 input to A3U304 output to X10, a measurement is made and the Main Controller (A1U501) performs error checking to DAC (A2U217) count limits of 512 ±472. This limit assures being within the calibration range of the DAC. Figure 8-9 illustrates some of the circuitry used for this test.

On error, if the **AUXERR?** command is executed, the number 128 will be displayed on the control panel if their are no other errors (See Table 8-2). This indicates an AC Amplifier DC Offset problem that could possibly be corrected by performing the **ACAL** command.

Test 8 checks the AC attenuator flatness on the 3V AC range. A 5V test signal is generated at A2U123 pin 13 and routed through A2U402 to the input of the A3 assembly. A measurement is made on the A3 assembly output signal and the Main Controller (A1U501) checks for convergence by checking to DAC (A2U217) count limits of 512 ±462. This limit assures being within the calibration range of the DAC. Figure 8-10 illustrates some of the circuitry used for this test.

On error, if the **AUXERR?** command is executed, the number 256 will be displayed on the control panel if their are no other errors (See Table 8-14). This indicates an AC attenuator flatness error that could possibly be corrected by performing an internal mechanical adjustment on A3C332 and/or by performing the **ACAL** command. To adjust A3C332, execute **DIAGNOSTIC 8** and adjust until the control panel display indicates "PASSED" (refer to the AC Converter Frequency Response Adjustment in section 5). If adjustment does not correct the error, executing **DIAGNOSTIC 8** puts this test into a looping condition. This is useful while troubleshooting as signals can be monitored.

Test 9 checks the ohms precharge circuitry on assembly A2/1. The unit is set to the 300 volt DC range with 1 power line cycle integration time and the latest auto calibration constant is sent to the A/D Controller (A2U501) from the Main Controller (A1U501). The input hybrid (A2U101) precharge amplifier is selected by input hybrid switch PRE as the input to input amplifier Q111 and a zero measurement is made. Next, a measurement is made through input hybrid switch MC. The difference between the two readings is computed and the Main Controller performs error checking to limits of 512 ±512 DAC counts. This limit assures being within the calibration range of the DAC. Figure 8-11 illustrates some of the circuitry used for this test.

On error, if the **AUXERR?** command is executed, the number 512 is displayed on the control panel if their are no other errors (See Table 8-14). This indicates an ohms precharge failure that could possibly be corrected by performing the **ACAL** command.

8-78. Self Test Changes for New Main Controller (03457-66511)

Due to a new main controller board change, minor changes have been made to self test execution. Auxiliary error codes 2048, 4096 and 8192 are no longer used. Designations for components used in the description of self tests 0, 1 and 2 have changed. The sections that follow include an updated table of error codes and an updated description of tests 0, 1, and 2.

8-79. Updated Power-on Self Tests

At instrument power-on, an abbreviated form of the complete Self Test procedure is executed to check the fundamental digital hardware kernel and the communication link between the Main Controller (A11U601) and A/D Controller (A2U501). This consists of executing Self Tests 0, 1 and 2 in that order. These 3 tests are discussed in detail in the following Self Test paragraphs.

Upon satisfactory completion of the power-on test routine, the instrument momentarily displays the HP-IB address it is currently set to (the address is set to decimal 22 at the factory), emits a single "beep" and sets itself to the predefined power-on state. The front panel indications of this state are; the DC Voltage function, Auto-Range and automatic trigger are selected. For a complete list of power-on conditions, refer to Section III, Table 3-1 in this manual.

Table 8-3. Self Test Failure Information

TEST#	AUXERR#	FAILURE DESCRIPTION
N/A	1	Isolation error in normal operation (not during self test)
1	2	A/D controller self test error
2	4	Isolation self test error
3	8	Integrator convergence error
4	16	Front end zero offset error
5	32	Current source, gain select or input divider error
6	64	Amps function error
7	128	AC amplifier DC offset error
8	256	AC attenuator flatness error
9	512	Ohms precharge circuit error
0	1024	U602 ROM checksum error
0	16384	Nonvolatile RAM (U603) or RAM protection circuit error

8-80. Updated Self Tests 0, 1, and 2 (TEST)

In addition to the 3 Power-on Self Tests, 7 other self tests may be executed by using the **TEST** command. All self tests are executed sequentially when the **TEST** command is executed and cannot be executed individually; however, the self tests are separated and numbered below to aid in troubleshooting.

Test 0 checks much of the circuitry on the Main Controller assembly A11. There are 2 subtests included in Test 0 and they are executed in the following sequence: 1) U602 ROM Checksum, 2) Nonvolatile RAM (U603) and RAM write protection circuitry test. These are also checked as part of the power-on test.

The ROM checksum tests against hard coded results. If the checksum of U602 is incorrect, executing the **AUXERR?** command will return a value of 1024. During the nonvolatile RAM test, FF, 55, 00 is written to each non-CALRAM location and read back (data presently in RAM is preserved). If the RAM test fails, the **AUXERR?** command would return 16384. The last part of test 0 writes to the CALRAM portion of the nonvolatile RAM and reads back. If the information written is read back, this indicates the RAM is not protected. In this case the **AUXERR?** command would return the value 16384.

Test 1 checks the A/D Controller (A2U501) reset procedure, RAM and ROM. Reset occurs primarily at power-on; however, Main Controller (A11U601) can force an A/D Controller hard reset by sending continuous 0 bytes across the communications link (A2U509/U510) for greater than 10mS. While checking the A/D Controller RAM and ROM, the A/D Controller performs the tests described below while the Main Controller (A11U601) checks the reported results against hard coded limits.

1. The A/D Controller RAM Test writes 55, 00 to each RAM location and reads it back. A RAM test failure will force the reported ROM checksum result to be in error. On failure, the **AUXERR?** command will return the value 2.

2. The A/D Controller ROM Test performs a checksum on the ROM and transmits the results to Main Controller A1U601. On failure, the **AUXERR?** command will return the value 2.

A subset of self test 1 is diagnostic 1 which will cause the A/D Controller to continually loop through the Test 1 routine. Executing **DIAGNOSTIC 1** allows monitoring of signals while troubleshooting.

Test 2 is a cross-isolation data communications test that transmits data between the Main Controller (A11U601) and the A/D Controller (A2U501) through opto-isolators A2U509/U510. The Main Controller will transmit a sequence of codes to the A/D Controller which will "ECHO BACK" these transmissions, as it receives them, to the Main Controller. The data returned to the Main Controller is then checked for accuracy. If the Main Controller finds an error in the returned data, the error annunciator will flash and executing the **AUXERR?** command will return a value of 4.

During this procedure, the Main Controller will wait for a response from the A/D Controller. If the Main Controller never receives a response from the A/D Controller then it will fall into diagnostic 2 and the display will indicate "FAILED".

The data is transmitted in 11 bit frames consisting of one start bit, 8 data bits, one parity bit and one stop bit. The data is decremented from decimal 16 to decimal 1, with each of the patterns being independently checked for errors. The A/D Controller remains in the "ECHO BACK" mode until it receives a decimal 0 data byte. At that time it will execute its 'soft reset' routine. This will set the A/D Controller to its operational state where it will wait for the Main Controller to direct further activity.

A subset of self test 2 is diagnostic 2 which continuously sends only 4 distinct bytes, FF, OF, 55 and 01 between the A/D Controller and the Main Controller for troubleshooting purposes.

Refer to Section 8-77. Self Test (Test) for information about tests 4 - 7.

8-81. Autocal (ACAL)

The Autocal routine is used to calibrate the AC amplifier DC offset and the Attenuator Flatness on AC assembly A3, and to calibrate the ohms precharge amplifier and check the extended ohms range (300 Mohm - 3 Gohm) on assembly A2. Each part of this routine is discussed below.

AC Amplifier DC Offset Auto Calibration

The DC Offset voltage of the amplifier circuitry on assembly A3 is calibrated on the 300V range and 3V range to correct for the different DC errors resulting from the two system gains of x10 and x100. System gain is defined as the gain from A3Q307 pin 3 to A3U304 pin 6 and is determined by the switch positions in A3U303. During Autocal of the DC Offset, the AC amplifier input is grounded by FET switch A3Q304 and any offset voltage from amplifier A3Q307/U302 is coupled through analog switch A3U303 to amplifier A3U304 which amplifies the error and adds any it may have. This offset error is measured and the results are used by the A/D Controller to set DAC A2U217 which provides an offset correction signal to the AC amplifier. Figure 8-12 illustrates some of the circuitry used during DC Offset Autocal.

AC Amplifier Attenuator Flatness Auto Calibration

Two input attenuators on assembly A3 are calibrated during an Autocal. One input attenuator is used for the 30mV and 300mV ranges and the other is used for the 3V, 30V and 300V ranges. During

"**ACAL**", a 0.5 volt and a 5.0 volt pulse signal is applied to the input attenuators and a measurement is made to determine the flatness of the signal. For more specific information, refer to the theory of operation discussion about AC to DC Converter Automatic Calibration. Figure 8-13 illustrates some of the circuitry used during the Attenuator Flatness Autocal.

Ohms Precharge Amplifier Auto Calibration

The Ohms Precharge Amplifier Autocal is similar to the Ohms Precharge Self Test 9. During Autocal, 16 measurements are made and a calibration constant is determined and placed into RAM, while in the confidence test a single measurement is made to determine if the readings are within specifications. Refer to test 9 to determine the circuitry being used during this portion of the ohms auto-cal.

Extended Ohms Range Auto Calibration

The extended ohms range is the 300 Mohm to 3 Gohm range. The Extended Ohms Range Autocal does not perform a calibration but it does perform a measurement on the 10 Mohm resistance (9.9 Mohm + 100 Kohm) within A2U101 at pin 1 and checks to determine if the value is 10 Mohm ±10%. Should a failure occur during this "**ACAL**" procedure, the **AUXERR?** command will return a value of 512 if there are no other errors. Figure 8-14 illustrates some of the circuitry used during the Extended Ohms Range Autocal.

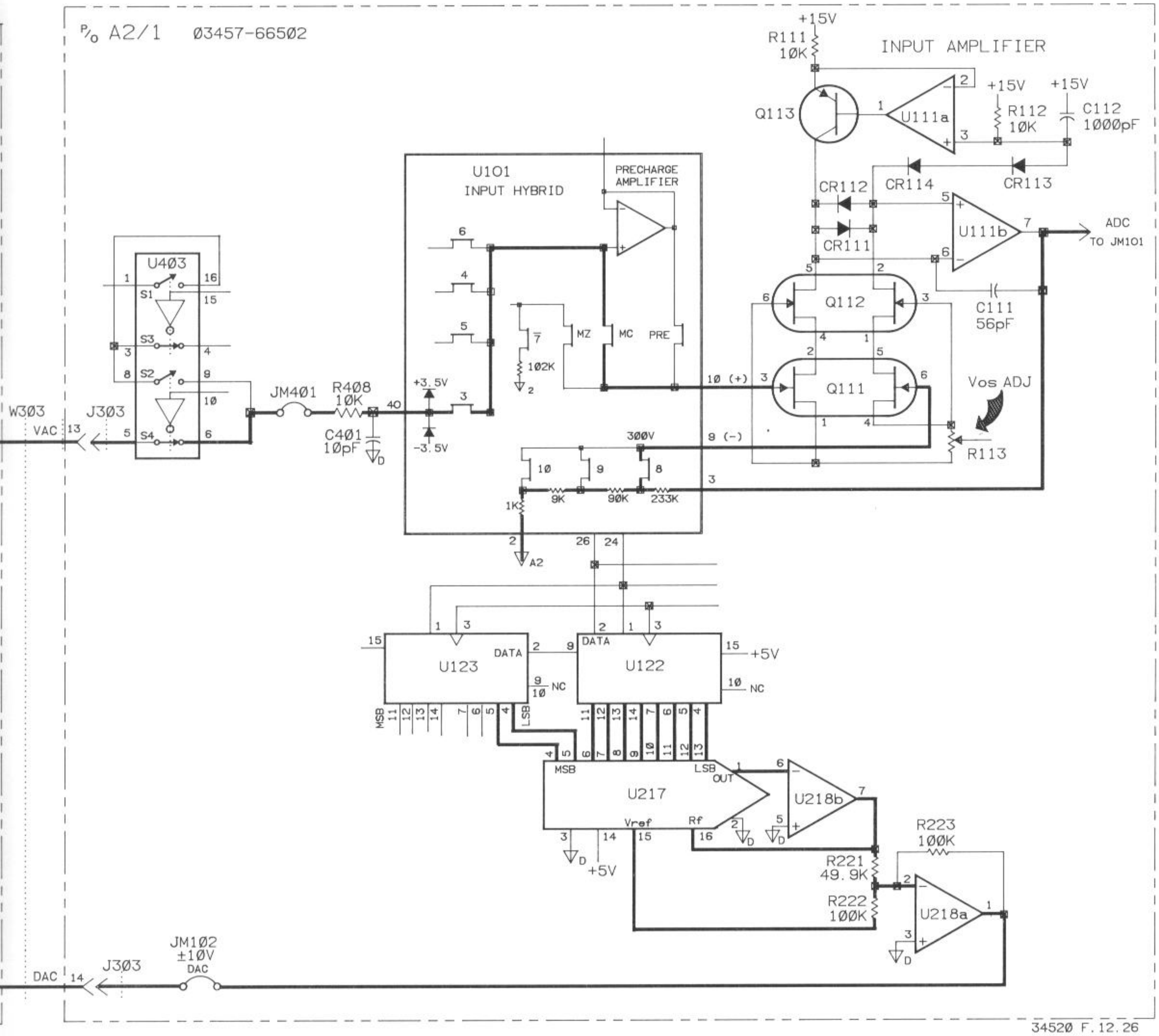
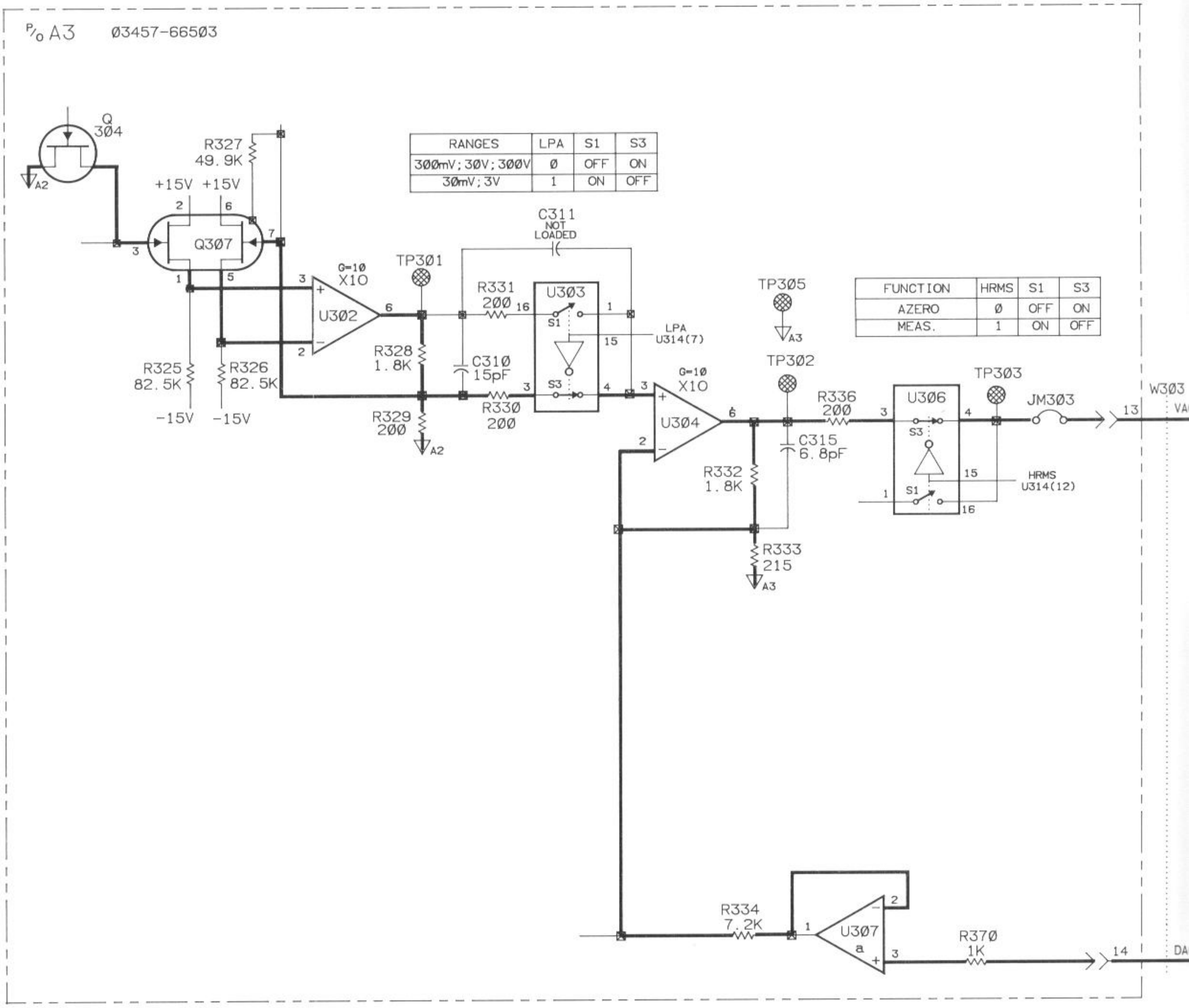

P/O A2/1 03457-66502
INPUT AMPLIFIER
+15V
R111 10K
Q113
U111a
+15V
R112 10K
+15V
C112 1000pF
CR112
CR114
CR113
CR111
U111b
ADC TO JM101
C111 56pF
Q112
Q111
Vos ADJ
R113
U101 INPUT HYBRID
PRECHARGE AMPLIFIER
MZ
MC
PRE
102K
+3.5V
-3.5V
10 (+)
9 (-)
300V
1K
9K
90K
233K
A2
U403
S1
S2
S3
S4
W303
J303
VAC
JM401
R408 10K
C401 10pF
U123
U122
DATA
MSB
LSB
NC
+5V
U217
OUT
Vref
Rf
U218b
U218a
R221 49.9K
R222 100K
R223 100K
JM102 ±10V DAC
DAC
34520 F.12.26

Figure 8-9. AC Amplifier DC Offset Circuitry



P/O A3 03457-66503
Q 304
A2
+15V +15V
R327 49.9K
Q307
3
2
6
7
1
5
R325 82.5K
R326 82.5K
-15V -15V
G=10 X10
U302
TP301
C311 NOT LOADED
R331 200
U303
16
S1
15
S3
LPA U314(7)
R328 1.8K
C310 15pF
R329 200
R330 200
A2
4
TP305
A3
TP302
G=10 X10
U304
R336 200
C315 6.8pF
R332 1.8K
R333 215
A3
U306
TP303
JM303
S3
S1
HRMS U314(12)
W303
13
VA
R334 7.2K
U307 a
R370 1K
14
DA

RANGES	LPA	S1	S3
300mV; 30V; 300V	0	OFF	ON
30mV; 3V	1	ON	OFF

FUNCTION	HRMS	S1	S3
AZERO	0	OFF	ON
MEAS.	1	ON	OFF

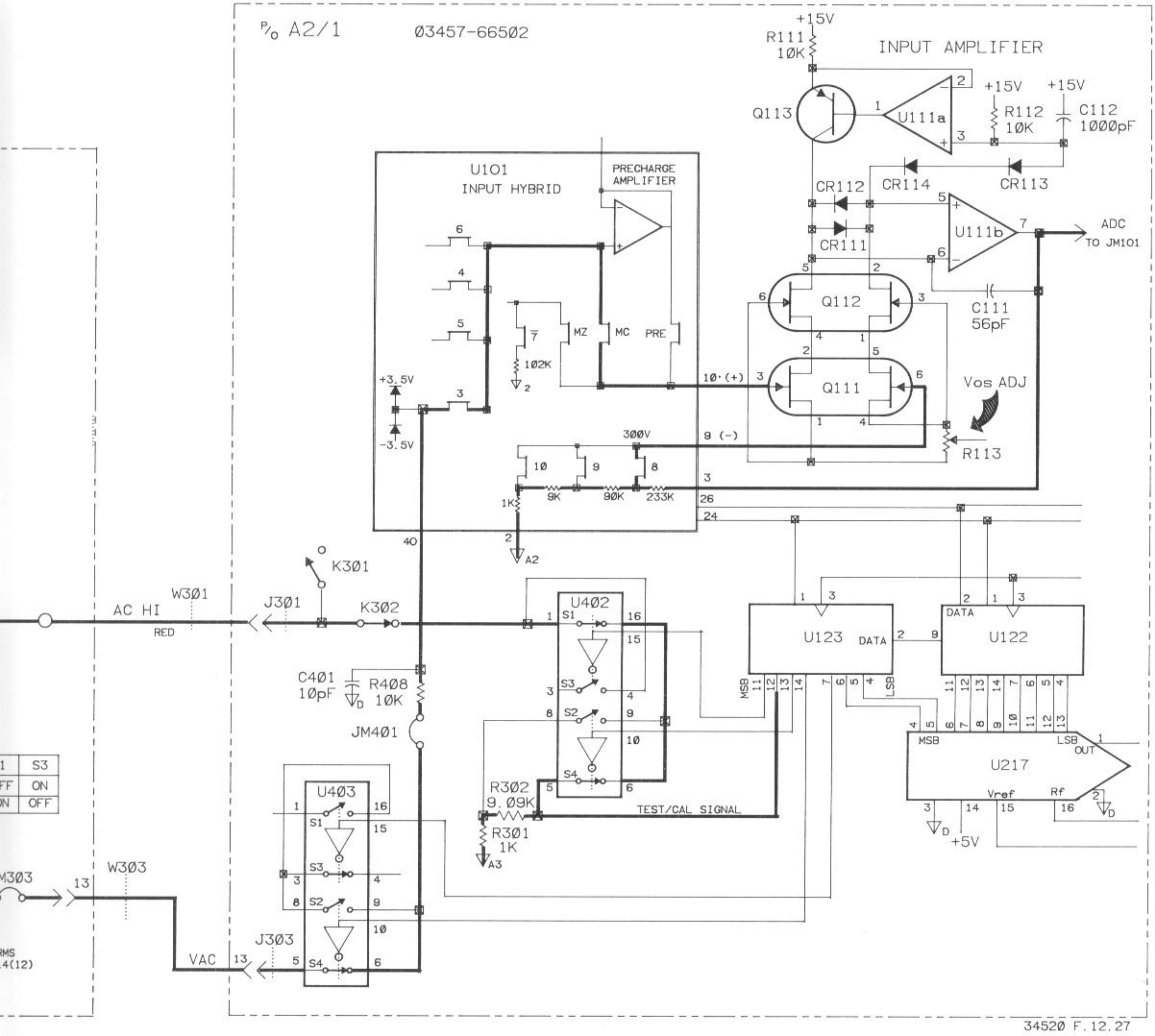
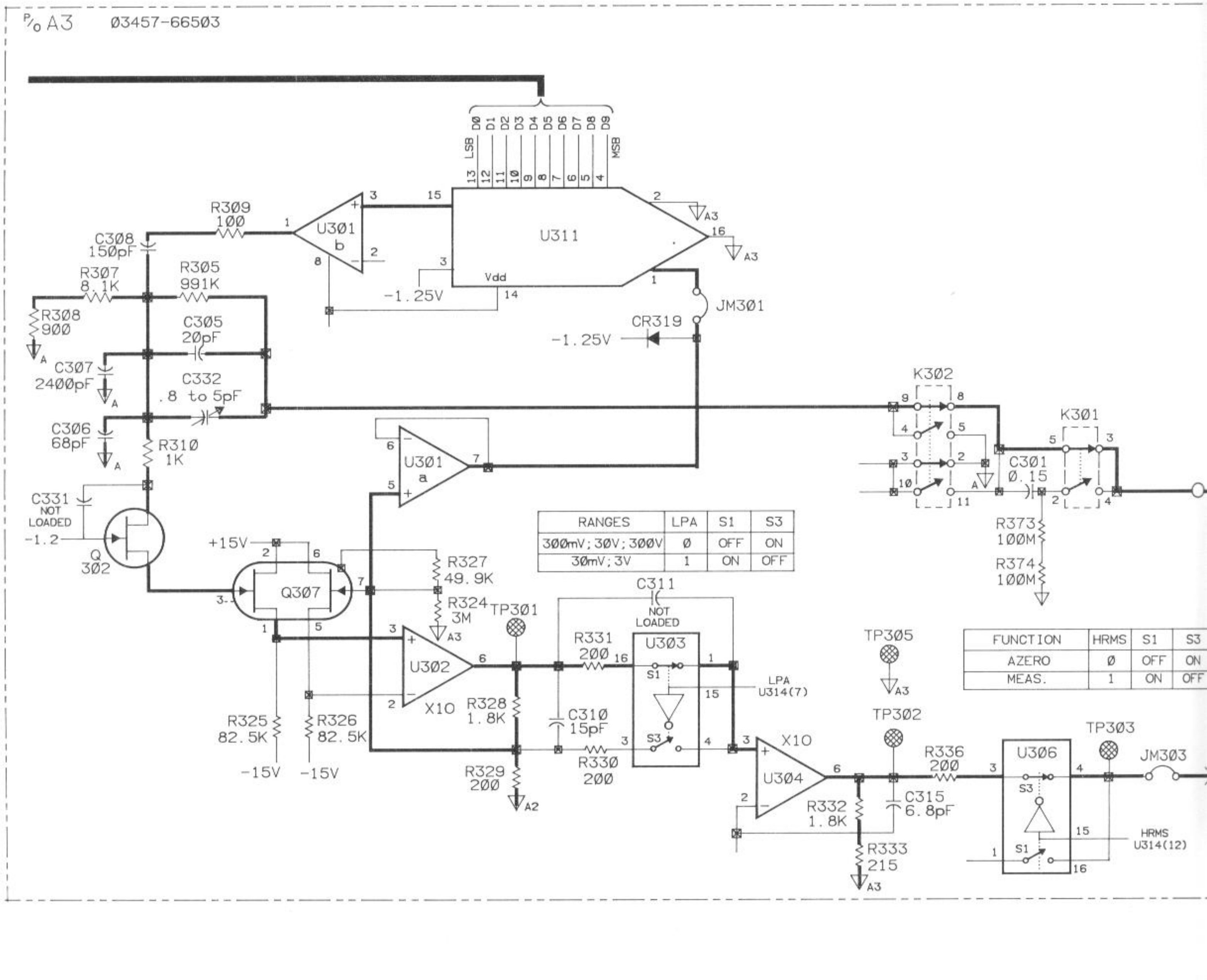

P/o A2/1
03457-66502
+15V
R111
10K
INPUT AMPLIFIER
Q113
U111a
+15V
+15V
R112
10K
C112
1000pF
CR113
CR114
CR112
CR111
U111b
ADC
TO JM101
C111
56pF
Q112
Q111
Vos ADJ
R113
U101
INPUT HYBRID
PRECHARGE
AMPLIFIER
MZ
MC
PRE
102K
+3.5V
-3.5V
10·(+)
9 (-)
300V
9K
90K
233K
1K
A2
K301
W301
AC HI
RED
J301
K302
U402
S1
S3
S2
S4
C401
10pF
R408
10K
JM401
R302
9.09K
R301
1K
A3
TEST/CAL SIGNAL
U123
DATA
MSB
LSB
U122
DATA
U217
MSB
LSB
OUT
Vref
Rf
+5V
U403
S3
ON
OFF
M303
W303
J303
VAC
RMS
34520 F.12.27

Figure 8-10. AC Attenuator Flatness Circuitry



P/o A3 03457-66503
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9
LSB
MSB
13 12 11 10 9 8 7 6 5 4
U311
15
2
16
A3
3
Vdd
14
1
-1.25V
JM301
CR319
-1.25V
U301 b
3
2
8
1
R309 100
C308 150pF
R307 8.1K
R305 991K
R308 900
C305 20pF
C307 2400pF
C332 .8 to 5pF
C306 68pF
R310 1K
C331 NOT LOADED
-1.2
Q 302
A
U301 a
6
7
5
+15V
2
6
Q307
3
7
1
5
R327 49.9K
R324 3M
A3
TP301
R325 82.5K
R326 82.5K
-15V
-15V
U302
X10
3
2
6
R328 1.8K
R329 200
A2
C311 NOT LOADED
R331 200
16
U303
S1
1
15
LPA U314(7)
C310 15pF
R330 200
3
S3
4
TP305
A3
TP302
X10
U304
3
2
6
R332 1.8K
R333 215
A3
C315 6.8pF
R336 200
3
U306
4
S3
15
HRMS U314(12)
1
S1
16
TP303
JM303
K302
9
8
4
5
3
2
10
11
A
K301
5
3
C301 0.15
2
4
R373 100M
R374 100M

RANGES	LPA	S1	S3
300mV; 30V; 300V	0	OFF	ON
30mV; 3V	1	ON	OFF

FUNCTION	HRMS	S1	S3
AZERO	0	OFF	ON
MEAS.	1	ON	OFF

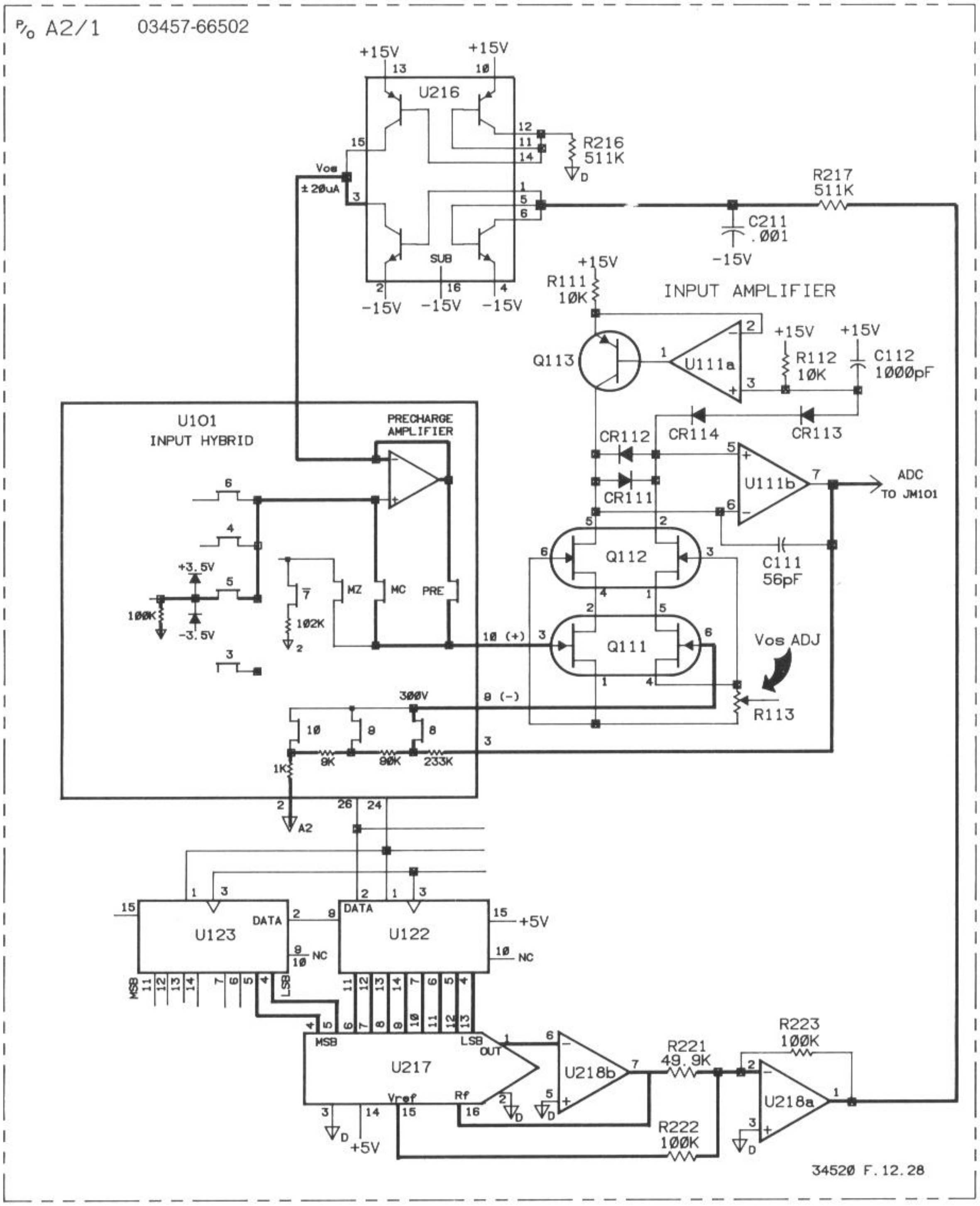

P/O A2/1
03457-66502
+15V
+15V
U216
R216
511K
Vos
±20uA
R217
511K
C211
.001
-15V
SUB
-15V
-15V
-15V
+15V
R111
10K
INPUT AMPLIFIER
Q113
U111a
+15V
+15V
R112
10K
C112
1000pF
U101
INPUT HYBRID
PRECHARGE
AMPLIFIER
CR112
CR114
CR113
CR111
U111b
ADC
TO JM101
Q112
C111
56pF
+3.5V
-3.5V
100K
102K
MZ
MC
PRE
10 (+)
Q111
Vos ADJ
300V
8 (-)
R113
9K
90K
233K
1K
A2
U123
DATA
U122
DATA
+5V
NC
NC
MSB
LSB
U217
MSB
LSB
OUT
Vref
Rf
U218b
R221
49.9K
R223
100K
U218a
R222
100K
+5V
34520 F.12.28

Figure 8-11. Ohms Precharge Circuitry

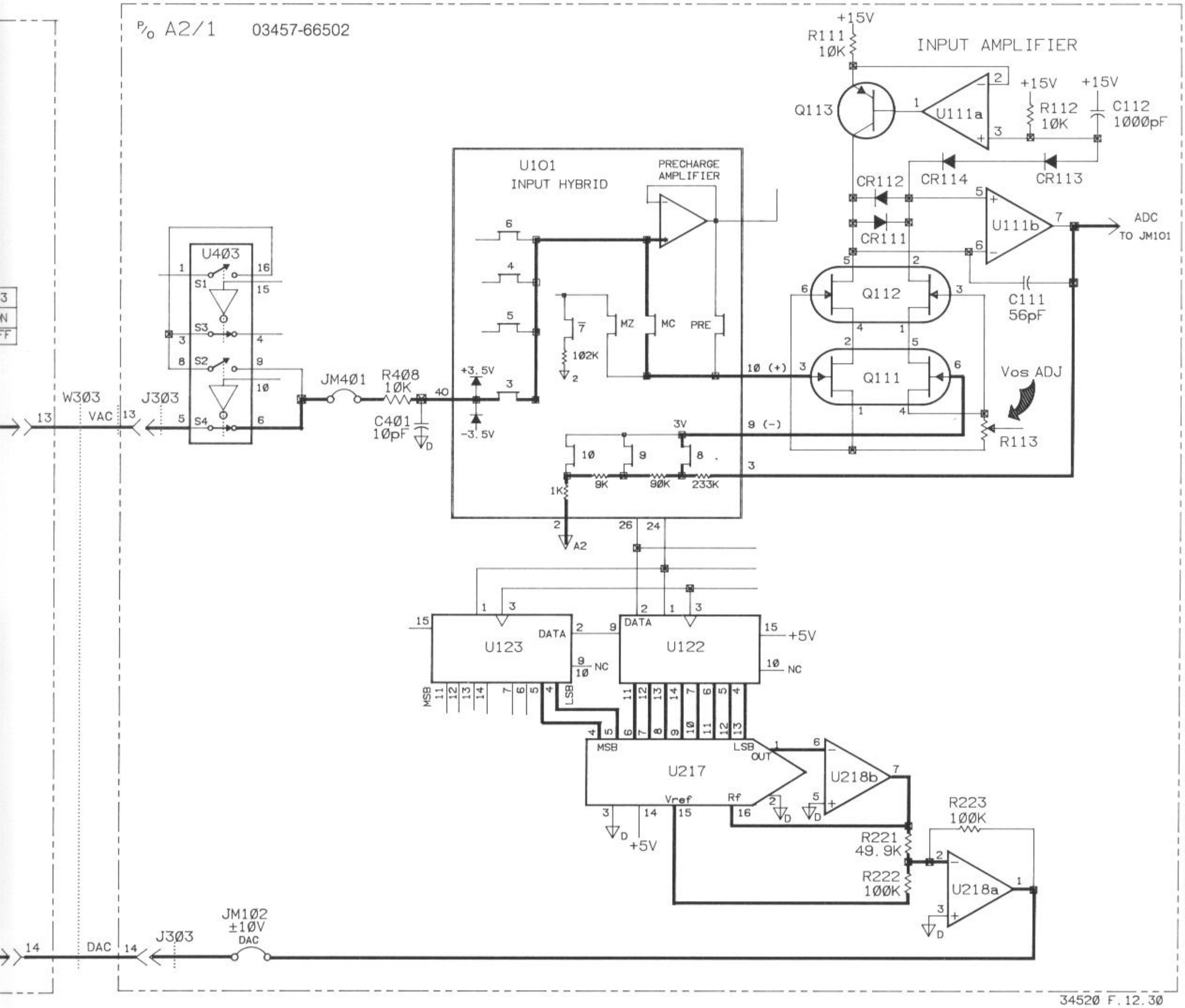
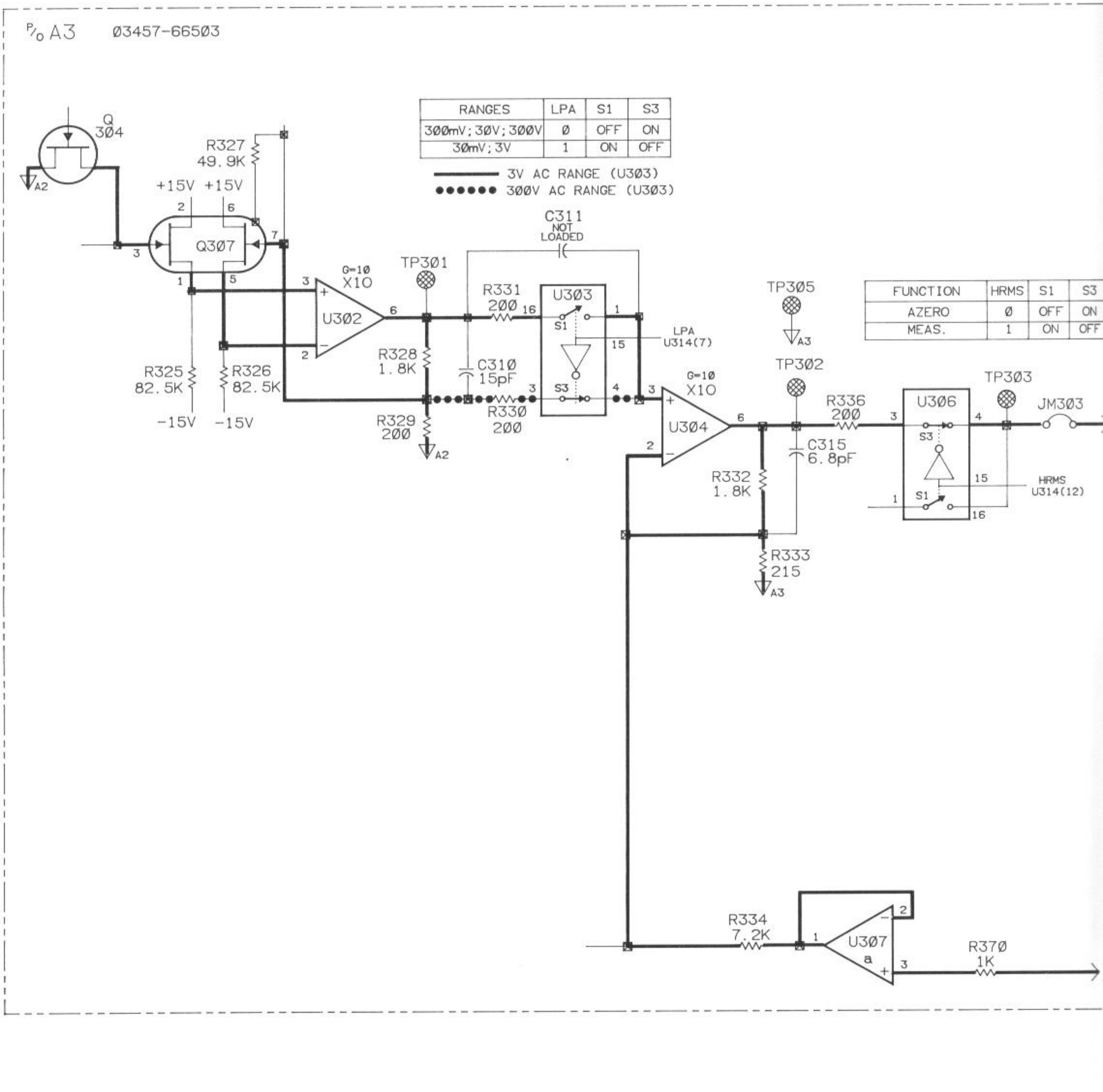

P/o A2/1 03457-66502
INPUT AMPLIFIER
+15V
R111 10K
Q113
U111a
+15V
R112 10K
+15V
C112 1000pF
CR113
CR114
CR112
CR111
U111b
ADC TO JM101
C111 56pF
Q112
Q111
Vos ADJ
R113
U101 INPUT HYBRID
PRECHARGE AMPLIFIER
MZ
MC
PRE
102K
10 (+)
9 (-)
3V
9K
90K
233K
1K
A2
+3.5V
-3.5V
U403
S1
S2
S3
S4
JM401
R408 10K
C401 10pF
W303
VAC
J303
DAC
JM102 ±10V DAC
U123
U122
DATA
NC
+5V
MSB
LSB
U217
OUT
Vref
Rf
U218b
U218a
R221 49.9K
R222 100K
R223 100K
34520 F.12.30

Figure 8-12. DC Offset Autocal Circuitry


P/o A3 03457-66503
Q304
A2
R327 49.9K
+15V +15V
Q307
R325 82.5K
R326 82.5K
-15V -15V
G=10 X10
U302
TP301
R328 1.8K
R329 200
A2
C311 NOT LOADED
R331 200
U303
S1
S3
C310 15pF
R330 200
LPA U314(7)
3V AC RANGE (U303)
300V AC RANGE (U303)
TP305
A3
TP302
G=10 X10
U304
C315 6.8pF
R332 1.8K
R333 215
A3
R336 200
U306
S3
S1
HRMS U314(12)
TP303
JM303
R334 7.2K
U307 a
R370 1K

RANGES	LPA	S1	S3
300mV; 30V; 300V	0	OFF	ON
30mV; 3V	1	ON	OFF

FUNCTION	HRMS	S1	S3
AZERO	0	OFF	ON
MEAS.	1	ON	OFF

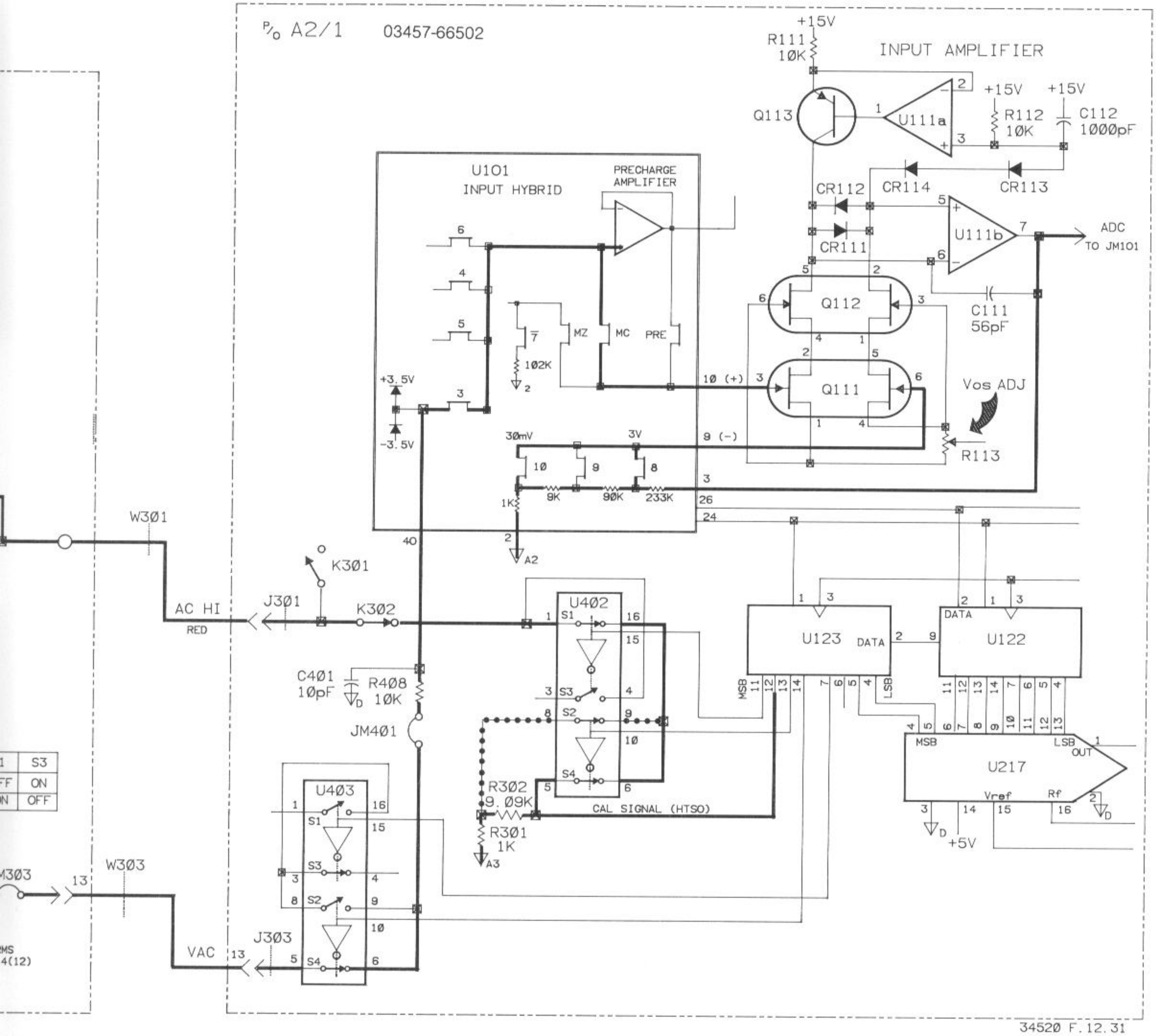
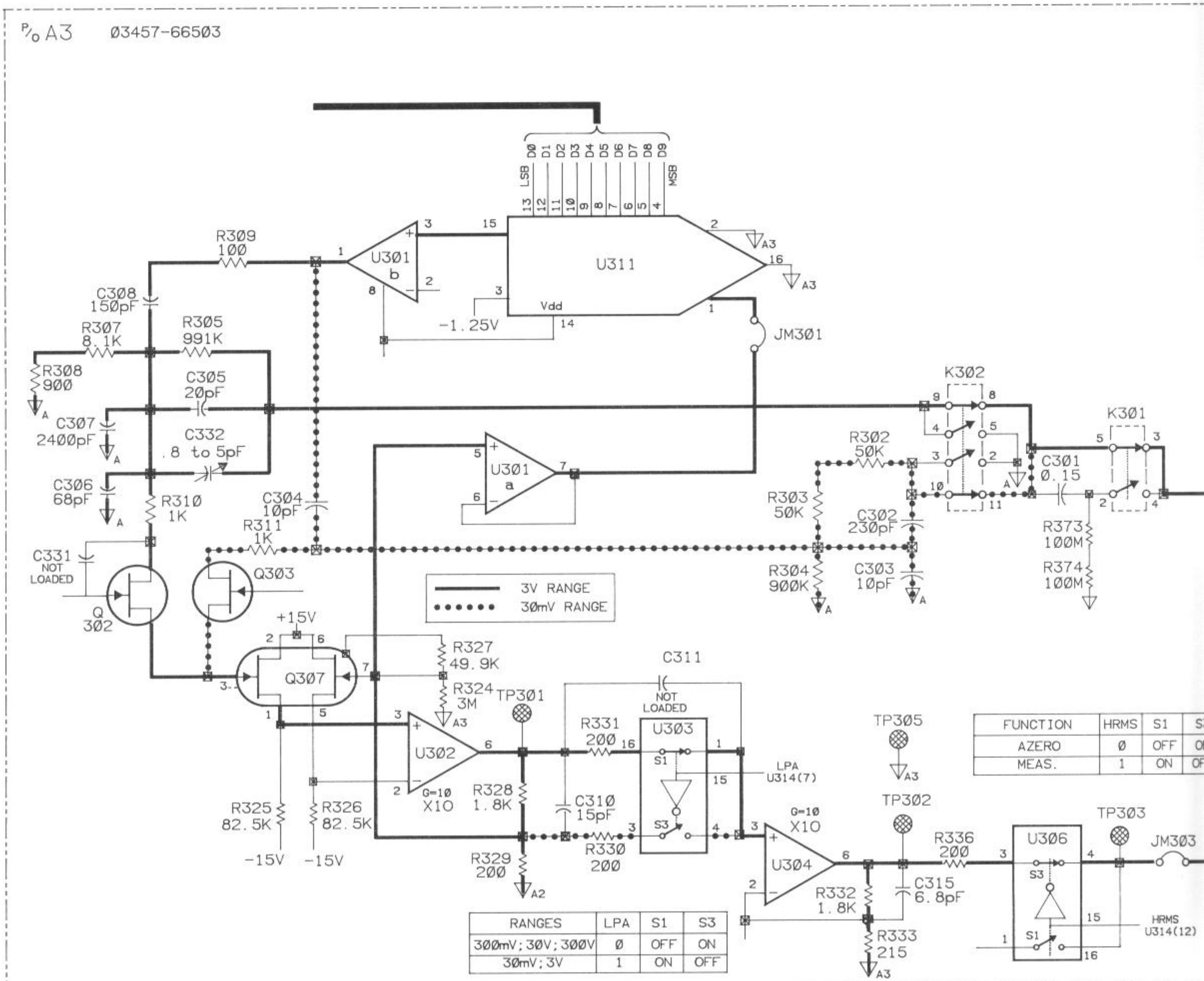

P/O A2/1 03457-66502
+15V
R111 10K
INPUT AMPLIFIER
Q113
U111a
+15V
+15V
R112 10K
C112 1000pF
CR112
CR114
CR113
CR111
U111b
ADC TO JM101
U101 INPUT HYBRID
PRECHARGE AMPLIFIER
Q112
C111 56pF
MZ
MC
PRE
102K
10 (+)
Q111
Vos ADJ
+3.5V
-3.5V
30mV
3V
9 (-)
R113
9K
90K
233K
1K
26
24
40
A2
W301
K301
AC HI
RED
J301
K302
U402
S1
S2
S3
S4
C401 10pF
R408 10K
JM401
U123
DATA
U122
MSB
LSB
U217
OUT
Vref
Rf
+5V
R302 9.09K
R301 1K
A3
CAL SIGNAL (HTSO)
U403
W303
J303
VAC
S3
ON
OFF
34520 F.12.31

Figure 8-13. Attenuator Flatness Circuitry


P/o A3
03457-66503
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9
LSB
MSB
13 12 11 10 9 8 7 6 5 4
U311
15
2
16
A3
3
Vdd
14
1
-1.25V
JM301
U301 b
1
3
2
8
R309 100
C308 150pF
R307 8.1K
R305 991K
R308 900
C305 20pF
C307 2400pF
C332 .8 to 5pF
C306 68pF
R310 1K
C304 10pF
R311 1K
C331 NOT LOADED
Q 302
Q303
U301 a
5
6
7
K302
9 8 4 5 3 2 10 11
R302 50K
R303 50K
R304 900K
C302 230pF
C303 10pF
K301
5 3 2 4
C301 0.15
R373 100M
R374 100M
3V RANGE
30mV RANGE
+15V
Q307
2 6 3 7 1 5
R327 49.9K
R324 3M
A3
TP301
U302
G=10
X10
3 6 2
R325 82.5K
R326 82.5K
-15V -15V
R328 1.8K
R329 200
A2
R331 200
C310 15pF
R330 200
C311
NOT LOADED
U303
S1
S3
16 1 15 3 4
LPA
U314(7)
TP305
A3
U304
G=10
X10
3 6 2
TP302
R332 1.8K
R333 215
A3
C315 6.8pF
R336 200
U306
S3 S1
3 4 15 1 16
TP303
JM303
HRMS
U314(12)

RANGES	LPA	S1	S3
300mV; 30V; 300V	0	OFF	ON
30mV; 3V	1	ON	OFF

FUNCTION	HRMS	S1	S
AZERO	0	OFF	O
MEAS.	1	ON	OF

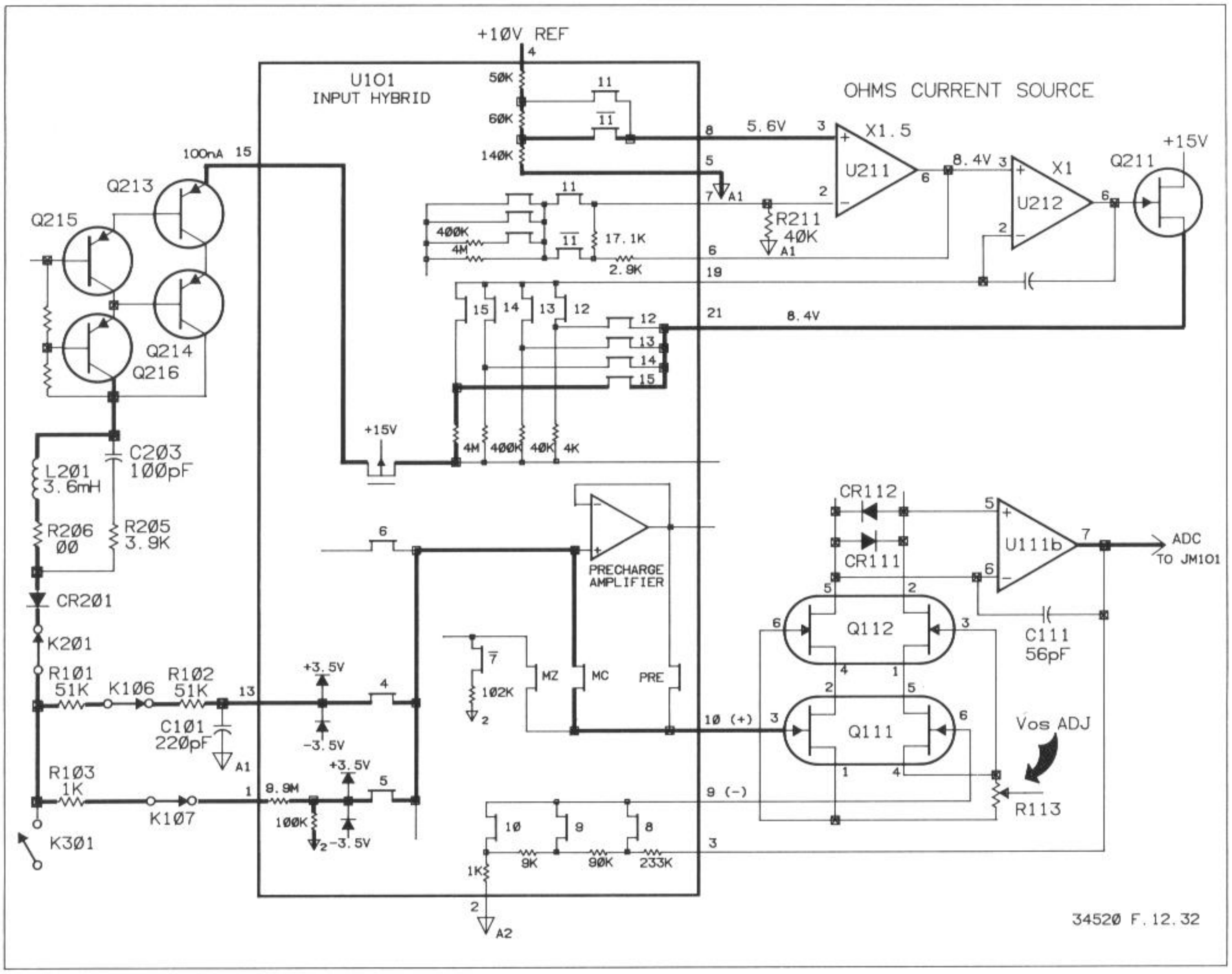

+10V REF
4
U101
INPUT HYBRID
50K
60K
140K
11
11
OHMS CURRENT SOURCE
8
5.6V
3
X1.5
+15V
100nA
15
5
U211
6
8.4V
3
X1
Q211
Q213
7
A1
2
R211
40K
A1
U212
6
Q215
11
400K
4M
11
17.1K
2.9K
6
19
2
15
14
13
12
12
13
14
15
21
8.4V
Q214
Q216
+15V
4M
400K
40K
4K
C203
100pF
L201
3.6mH
R206
00
R205
3.9K
CR112
5
U111b
7
ADC
TO JM101
6
CR111
6
PRECHARGE
AMPLIFIER
5
2
CR201
6
Q112
3
C111
56pF
K201
4
1
7
102K
2
MZ
MC
PRE
R101
51K
K106
R102
51K
13
+3.5V
4
2
5
-3.5V
C101
220pF
A1
10 (+)
3
Q111
6
Vos ADJ
R103
1K
K107
1
8.9M
100K
+3.5V
5
-3.5V
2
1
4
9 (-)
R113
10
9
8
K301
9K
90K
233K
3
1K
2
A2
34520 F.12.32

Figure 8-14. Extended Ohms Range Circuitry

8-82. Plug-in Cards

In general, to verify faulty operation or to find a failed component of a plug-in card option requires probing of various signals on the card. In order to probe the card the following disassembly procedures should be followed.

1) Remove all power from the card and the instrument.

2) Remove the card from the instrument. (see section 6-15)

3) Remove the instrument's top cover. (see section 6-21)

4) Fold the metal bracket, that connects the instrument to the plug-in card, over the front of the instrument.

5) Remove the shield from the card. This requires removal of four screws. Once the circuit board is free from the shield, precautions should be taken to prevent the board and its components from being exposed to electrostatic discharge (ESD). The circuit board should only be handled by properly grounded personnel.

6) Slide the circuit board into the plastic guides of the metal bracket with the component side up. Two connections must be made to the board, one to a plastic connector mounted on the metal bracket and the other to a five wire clamp connector.

7) Be sure that nothing is connected to the instrument's front terminals or touching the exposed circuit board. Connect power to the instrument and turn it on.

8-83. 44491A

If the instrument does not work when the card is installed:

a) Check the +5 volt supply coming into the board at connector P801.
b) Cut jumpers JM807/JM808. If the instrument begins working replace U802. If it does not begin working replace U801. These shift registers can load down data lines SDS, SD0 or SDC 2 which will prevent the instrument from working.
c) Replace jumpers JM807/JM808.

If the instrument works but the channels are not operating correctly, the following items should be checked:

1) If another relay beside the desired relay is switching, check the steering diodes (CR808-CR827) associated with the bad channel. For instance, if when switching K802, K808 also switches, check CR822 and CR823 to make sure they are not shorted.

2) If a relay has some contacts that work correctly and others that don't, replace the relay. To determine if the contacts are working, instruct a channel to close and then measure the resistance from the correct pin of connector P802 to the correct pin of connector P803.

3) If none of the contacts of a relay work, the problem must be isolated to either the drive circuitry for the relay or the relay itself.

a) Measure the resistance of the relay's coil between pins 1 and 12. The resistance should be between 60 and 70 ohms.

b) Check the voltage applied to the relay coil. This can be done by connecting an oscilloscope across the relay's coil and executing the following command, "TERM REAR;SADV AUTO;NPLC 0;AZERO OFF;DCV 30;SLIST xx". Where xx indicates the channel being tested. This will set up the voltmeter to continuously cycle (SETting and RESETting) the relay. If the voltage is greater than 2.5 volts the relay should be working. If the relay does not respond, replace the relay. If the voltage is less than 2.5 volts, check the drive circuitry.

4) To test the drive circuitry for each relay requires checking the associated row and column drivers for the correct signal levels. This can be done by tracing signal levels from outputs of the shift registers through the correct circuitry to the relay coil. Since relay drivers are active for only 10 milliseconds, the command "TERM REAR;SADV AUTO;NPLC 0;AZERO OFF;DCV 30;DISP OFF;SLIST xx" will continually cycle channel xx's drive circuitry allowing the signal levels to be checked with an oscilloscope. The table below lists the correct output of shift registers U801 and U802 for operation of each relay.

Table 8-4. Shift Register Outputs

Relay Condition	Data (hex)	U802		U801	
		Q8Q7Q6Q5	Q4Q3Q2Q1	Q8Q7Q6Q5	Q4Q3Q2Q1
During Instrument Measurement	5FDF	0 1 0 1	1 1 1 1	1 1 0 1	1 1 1 1
SET					
K800	FF57	1 1 1 1	1 1 1 1	0 1 0 1	0 1 1 1
K801	F7DD	1 1 1 1	0 1 1 1	1 1 0 1	1 1 0 1
K802	FBDB	1 1 1 1	1 0 1 1	1 1 0 1	1 0 1 1
K803	FDDE	1 1 1 1	1 1 0 1	1 1 0 1	1 1 1 0
K804	4EFF	0 1 0 0	1 1 1 0	1 1 1 1	1 1 1 1
K805	5F77	0 1 0 1	1 1 1 1	0 1 1 1	0 1 1 1
K806	57FD	0 1 0 1	0 1 1 1	1 1 1 1	1 1 0 1
K807	5DFE	0 1 0 1	1 1 0 1	1 1 1 1	1 1 1 0
K808	5BFB	0 1 0 1	1 0 1 1	1 1 1 1	1 0 1 1
K809	4EFF	0 1 0 0	1 1 1 0	1 1 1 1	1 1 1 1
RESET					
K800	00C8	0 0 0 0	0 0 0 0	1 1 0 0	1 0 0 0
K801	0842	0 0 0 0	1 0 0 0	0 1 0 0	0 0 1 0
K802	0444	0 0 0 0	0 1 0 0	0 1 0 0	0 1 0 0
K803	0241	0 0 0 0	0 0 1 0	0 1 0 0	0 0 0 1
K804	5110	0 1 0 1	0 0 0 1	0 0 0 1	0 0 0 0
K805	4098	0 1 0 0	0 0 0 0	1 0 0 1	1 0 0 0
K806	4812	0 1 0 0	1 0 0 0	0 0 0 1	0 0 1 0
K807	4211	0 1 0 0	0 0 1 0	0 0 0 1	0 0 0 1
K808	4414	0 1 0 0	0 1 0 0	0 0 0 1	0 1 0 0
K809	1140	0 0 0 1	0 0 0 1	0 1 0 0	0 0 0 0

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If the instrument does not work when the card is installed:

a) Check the +5 volt supply coming into the board at connector P851.

b) Cut jumpers JM851/JM852. If the instrument begins working replace U852. If it does not begin working replace U851. These shift registers can load down the serial data lines SDS, SD0, or SDC2 which will prevent the instrument from working.

c) Replace jumpers JM851/JM852.

If the instrument works but the channels are not operating correctly, the following items should be checked:

1) Check for the correct output from U851 and U852. All outputs should be high except for the output to the relay being closed. To close relay K851 (channel 0) requires that output Q1 of shift register U851 be held low. The drive signal must remain low the entire time the relay is closed.

2) If the output of the shift registers is correct, check the output of drive transistors U853-U855. If relay K851 is closed, the output of U854 pin 14 should be approximately +5 volts. If it is not, replace the transistor pack.

3) If the drive signal is working and the contacts do not operate correctly, replace the relay. Contact operation can be checked by making a resistance measurement from the correct pin of connector P853 to the correct pin of connector P852. To check the high contact of relay K851, resistance should be measured between connector P853 pin 1 and connector P852 pin 22.

8-85. Replacement Procedures

Procedures for the removal and replacement of the PC assemblies are contained in Section VI of this manual. Please observe clean handling techniques and anti-static procedures when handling the PC assemblies.

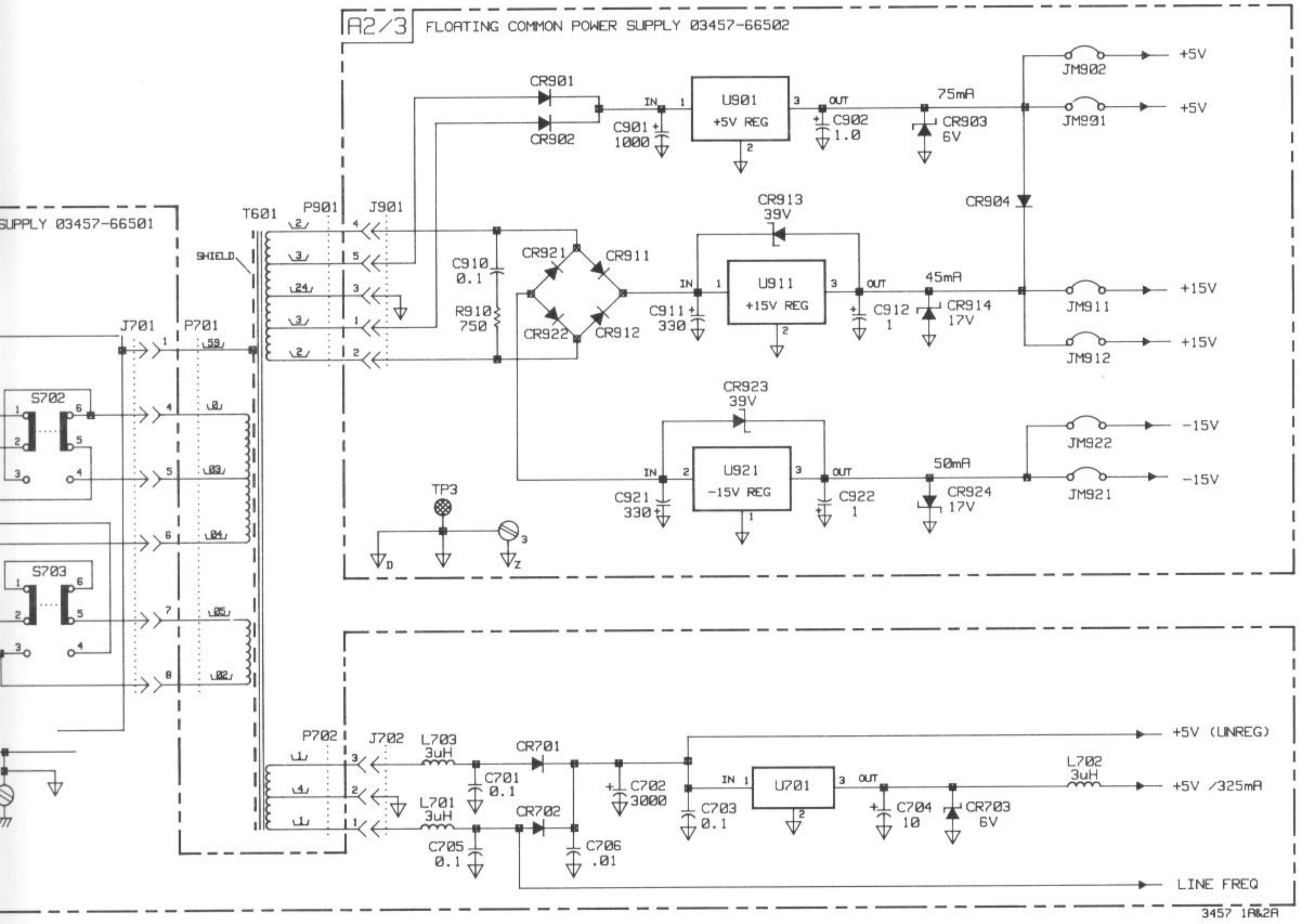
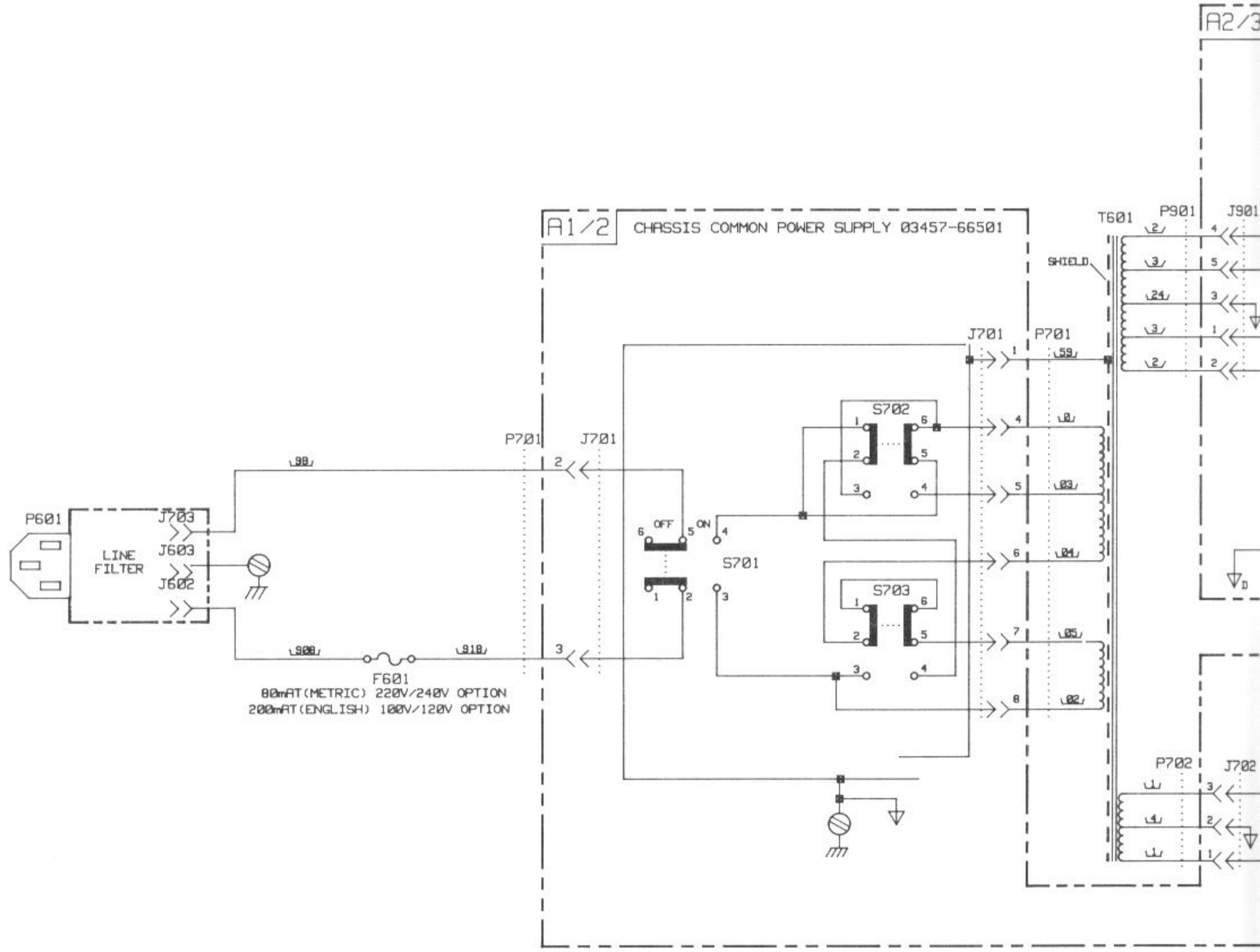
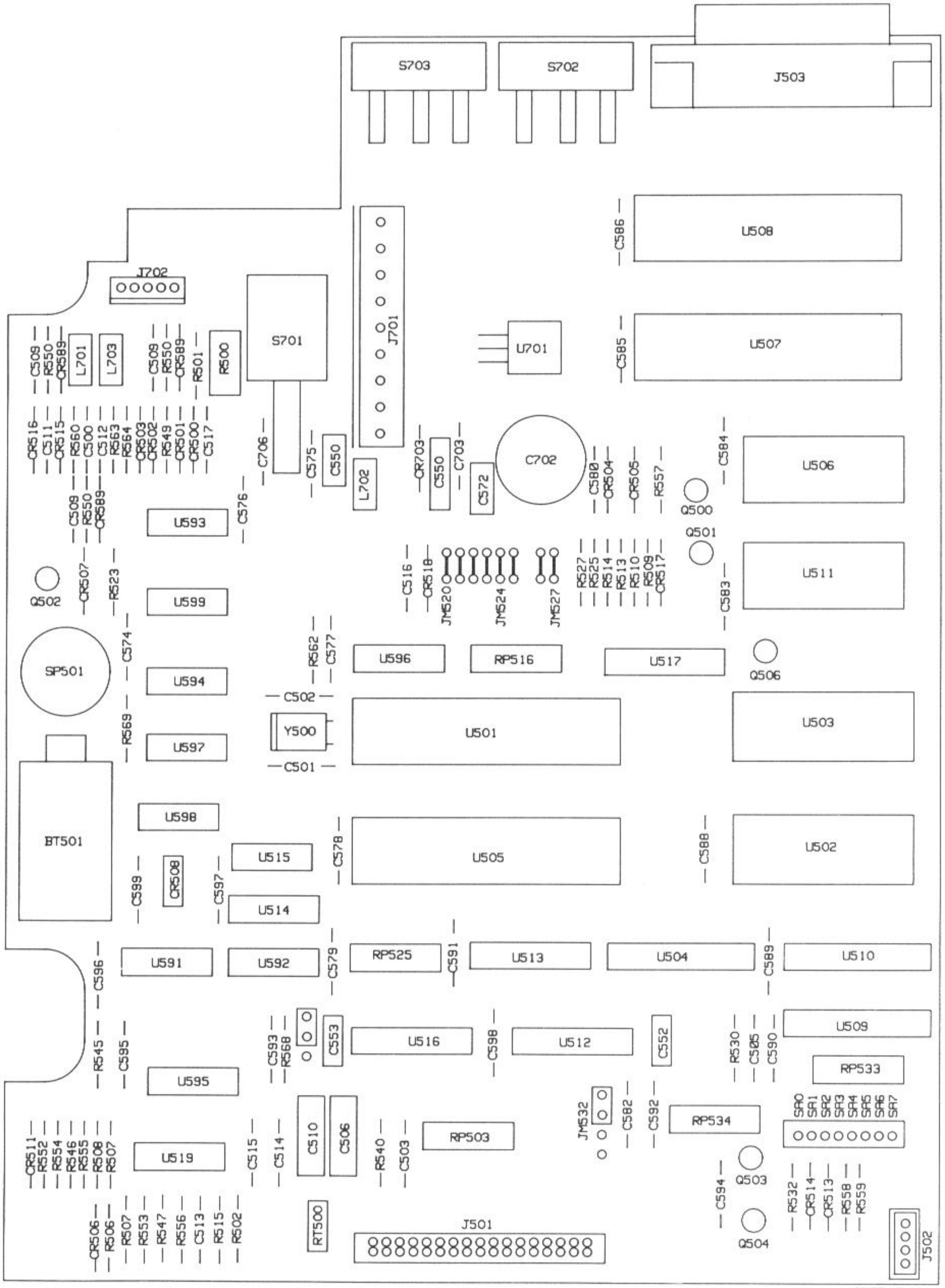
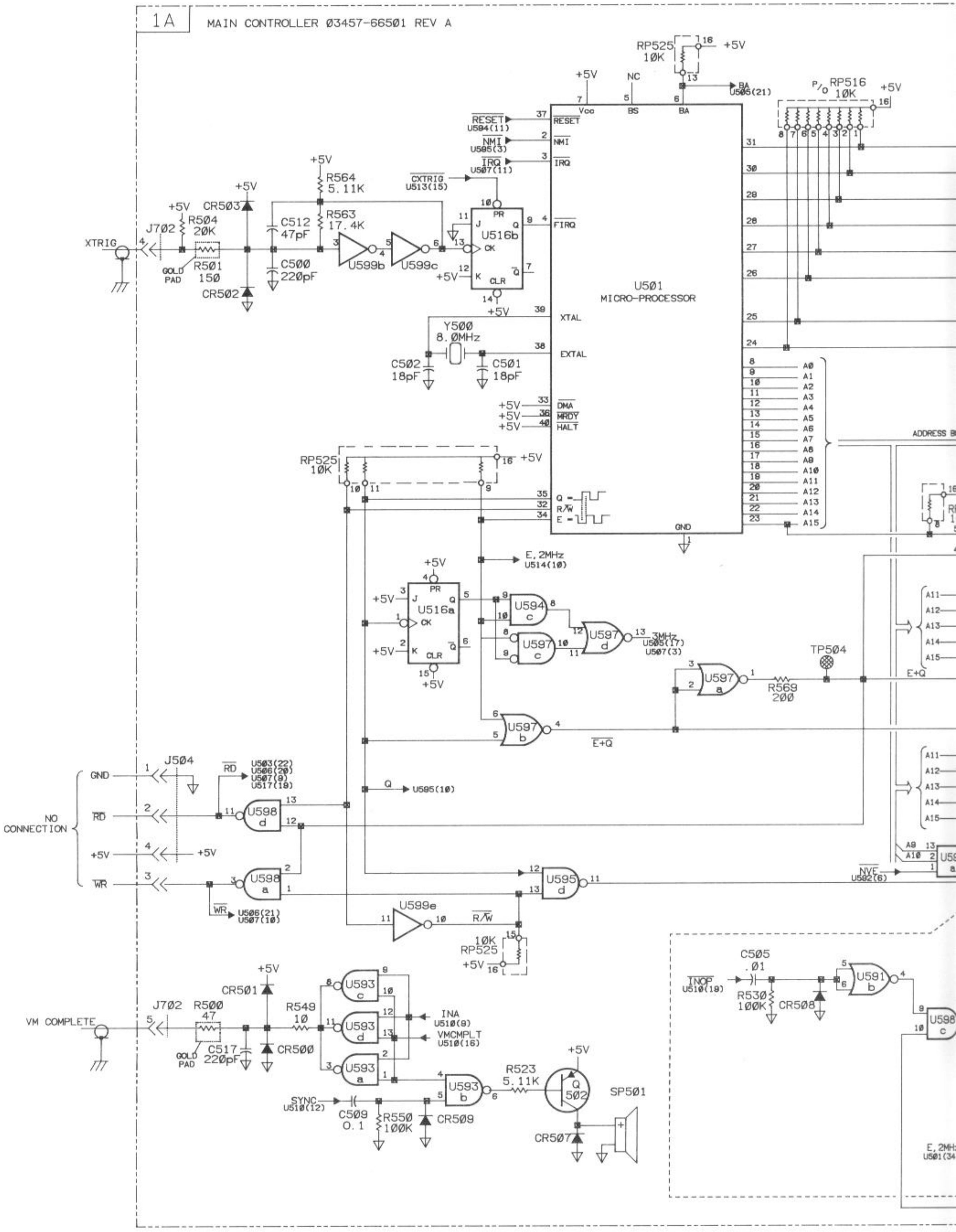

A2/3 FLOATING COMMON POWER SUPPLY 03457-66502
SUPPLY 03457-66501
CR901
CR902
C901 1000
IN 1
U901 +5V REG
2
3 OUT
C902 1.0
75mA
CR903 6V
JM902
+5V
JM901
+5V
CR904
T601
P901
J901
SHIELD
2
3
24
3
2
4
5
3
1
2
C910 0.1
R910 750
CR921
CR911
CR922
CR912
CR913 39V
C911 330
U911 +15V REG
C912 1
45mA
CR914 17V
JM911
+15V
JM912
+15V
CR923 39V
C921 330
U921 -15V REG
C922 1
50mA
CR924 17V
JM922
-15V
JM921
-15V
TP3
D
Z
3
J701
P701
59
0
03
04
05
02
S702
S703
1
2
3
4
5
6
7
8
P702
J702
L703 3uH
L701 3uH
C701 0.1
C705 0.1
CR701
CR702
C706 .01
C702 3000
C703 0.1
U701
C704 10
CR703 6V
L702 3uH
+5V (UNREG)
+5V /325mA
LINE FREQ
3457 1A&2A

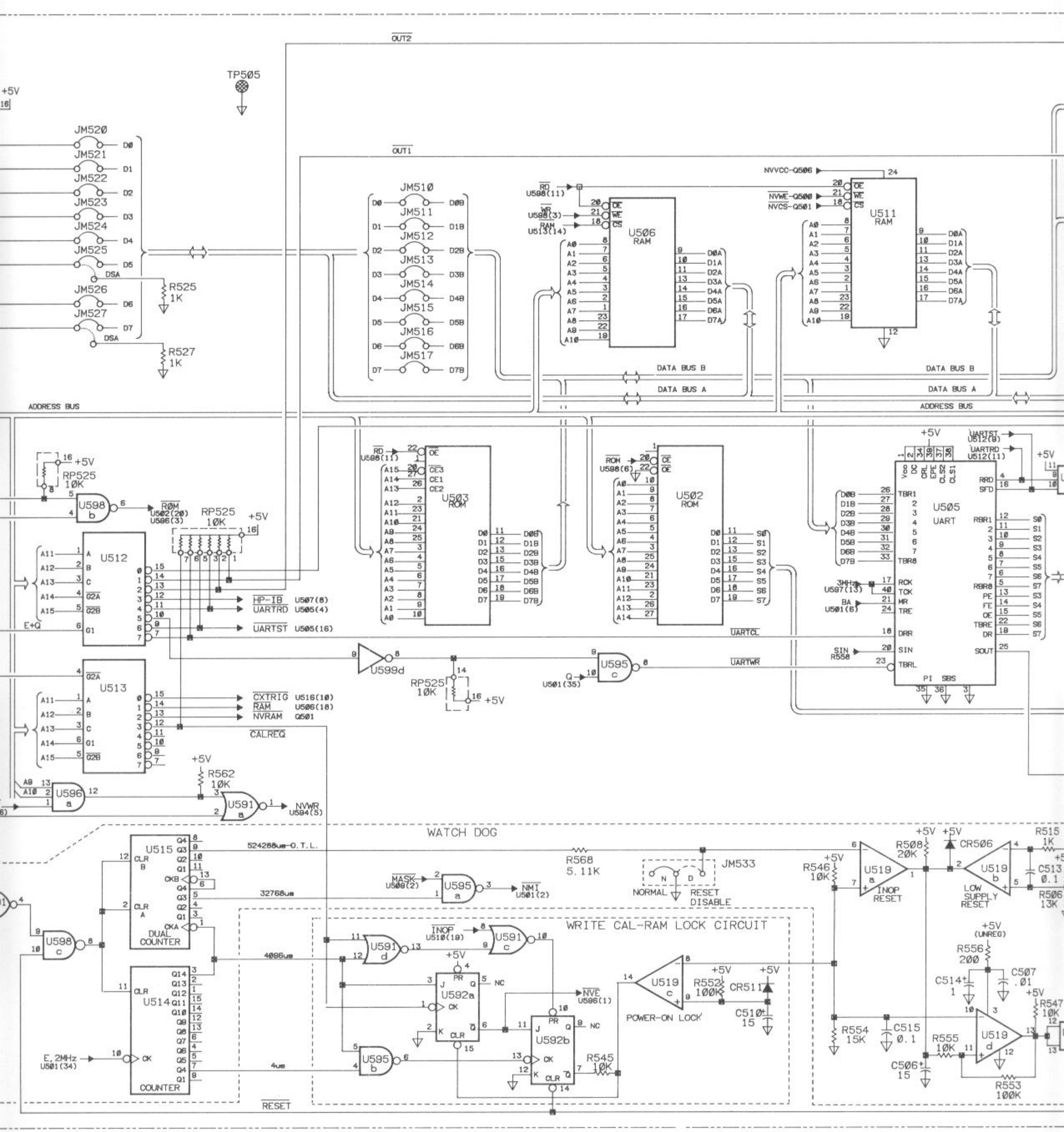
Figure 8-15. Power Supplies


A1/2
CHASSIS COMMON POWER SUPPLY 03457-66501
A2/3
P601
LINE FILTER
J703
J603
J602
98
908
918
F601
80mAT(METRIC) 220V/240V OPTION
200mAT(ENGLISH) 100V/120V OPTION
P701
J701
2
3
S701
OFF
ON
6
5
4
1
2
3
S702
S703
J701
P701
59
0
03
04
05
02
1
4
5
6
7
8
T601
SHIELD
P901
J901
2
3
24
3
2
4
5
3
1
2
D
P702
J702
1
4
1
3
2
1


S703
S702
J503
J702
J701
S701
R500
L701
L703
U508
U507
U701
C702
U506
U511
L702
C550
C572
U593
U599
Q502
SP501
U594
U597
Y500
U501
U596
RP516
U517
U503
Q500
Q501
Q506
BT501
U598
U515
U514
CR508
U505
U502
U591
U592
RP525
U513
U504
U510
U516
U512
C553
C552
U509
RP533
U595
RP534
RP503
C510
C506
U519
RT500
J501
J502
JM520
JM524
JM527
JM532
Q503
Q504
SA0
SA1
SA2
SA3
SA4
SA5
SA6
SA7
C501
C502
C586
C585
C584
C583
C588
C589
C590
C505
R530
C594
R532
CR514
CR513
R558
R559
C592
C582
C591
C598
C579
C578
C593
R568
C515
C514
R540
C503
C596
C595
R545
C599
C597
C574
R569
R562
C577
CR507
R523
C576
C706
C575
CR703
C703
C580
CR504
CR505
R557
C516
CR518
R527
R525
R514
R513
R510
R509
CR517
C509
R550
CR589
CR516
C511
CR515
R560
C500
C512
R563
R564
CR503
CR502
R549
CR501
CR500
C517
R501
CR511
R552
R554
R546
R555
R508
R507
CR506
R506
R553
R547
R556
C513
R515
R502

3457 CL1


1A
MAIN CONTROLLER 03457-66501 REV A
RP525 10K
+5V
BA U505(21)
P/O RP516 10K
NC
Vcc
BS
BA
RESET U504(11)
NMI U505(3)
IRQ U507(11)
CXTRIG U513(15)
FIRQ
U501 MICRO-PROCESSOR
XTAL
EXTAL
Y500 8.0MHz
C502 18pF
C501 18pF
DMA
MRDY
HALT
GND
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
ADDRESS B
XTRIG
J702
R504 20K
GOLD PAD
R501 150
CR503
CR502
C512 47pF
C500 220pF
R564 5.11K
R563 17.4K
U599b
U599c
U516b
PR
CK
CLR
Q = R/W E =
E, 2MHz U514(10)
U516a
U594 c
U597 c
U597 d
3MHz U505(7) U507(3)
TP504
U597 a
R569 200
E+Q
U597 b
J504
GND
RD
+5V
WR
NO CONNECTION
RD U503(22) U506(20) U507(9) U517(19)
U598 d
U598 a
Q U595(10)
WR U506(21) U507(10)
U595 d
NVF U592(6)
U599e
R/W
10K RP525
VM COMPLETE
J702
R500 47
C517 220pF
CR501
CR500
R549 10
U593 c
U593 d
U593 a
U593 b
INA U510(9)
VMCMPLT U510(16)
SYNC U510(12)
C509 0.1
R550 100K
CR509
R523 5.11K
Q 502
SP501
CR507
INOP U510(19)
C505 .01
R530 100K
CR508
U591 b
U598 c
E, 2MHz U501(34)


OUT2
TP505
+5V
OUT1
JM520
JM521
JM522
JM523
JM524
JM525
JM526
JM527
D0
D1
D2
D3
D4
D5
D6
D7
DSA
R525
1K
R527
1K
JM510
JM511
JM512
JM513
JM514
JM515
JM516
JM517
D0B
D1B
D2B
D3B
D4B
D5B
D6B
D7B
RD
U598(11)
WR
U598(3)
RAM
U513(14)
U506
RAM
OE
WE
CS
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
D0A
D1A
D2A
D3A
D4A
D5A
D6A
D7A
NVVCC-Q506
NVWE-Q500
NVCS-Q501
U511
RAM
DATA BUS B
DATA BUS A
ADDRESS BUS
RP525
10K
U598
b
ROM
U502(20)
U596(3)
U512
A11
A12
A13
A14
A15
E+Q
G1
G2A
G2B
HP-IB U507(8)
UARTRD U505(4)
UARTST U505(16)
U513
CXTRIG U516(10)
RAM U506(18)
NVRAM Q501
CALREQ
U503
ROM
CE3
CE1
CE2
U599d
RP525
10K
U595
c
Q
U501(35)
UARTWR
UARTCL
ROM
U598(6)
U502
ROM
S0
S1
S2
S3
S4
S5
S6
S7
U505
UART
UARTST
U512(9)
UARTRD
U512(11)
Vcc
DC
CRL
EPE
CLS2
CLS1
TBR1
TBR8
RCK
TCK
MR
TRE
DRR
SIN
TBRL
3MHz
U597(13)
BA
U501(6)
SIN
R558
RRD
SFD
RBR1
RBR8
PE
FE
OE
TBRE
DR
SOUT
PI
SBS
A9
A10
U596
a
+5V
R562
10K
U591
a
NVWR
U594(5)
WATCH DOG
U515
CLR
B
A
CKB
CKA
DUAL COUNTER
Q4
Q3
Q2
Q1
524288us-O.T.L.
32768us
R568
5.11K
JM533
N
D
NORMAL
RESET DISABLE
MASK
U509(2)
U595
a
NMI
U501(2)
U598
c
4096us
U514
COUNTER
Q14
Q13
Q12
Q11
Q10
Q9
Q8
Q7
Q6
Q5
E, 2MHz
U501(34)
4us
RESET
WRITE CAL-RAM LOCK CIRCUIT
U591
d
INOP
U510(10)
U591
c
U592a
PR
J
K
CK
CLR
NC
U592b
NVE
U596(1)
U595
b
R545
10K
U519
c
POWER-ON LOCK
R552
100K
CR511
C510
15
R508
20K
CR506
R546
10K
U519
a
INOP RESET
U519
b
LOW SUPPLY RESET
R515
1K
C513
0.1
R506
13K
+5V (UNREG)
R556
200
C514
1
C507
.01
R554
15K
C515
0.1
R555
10K
U519
d
R547
10K
C506
15
R553
100K

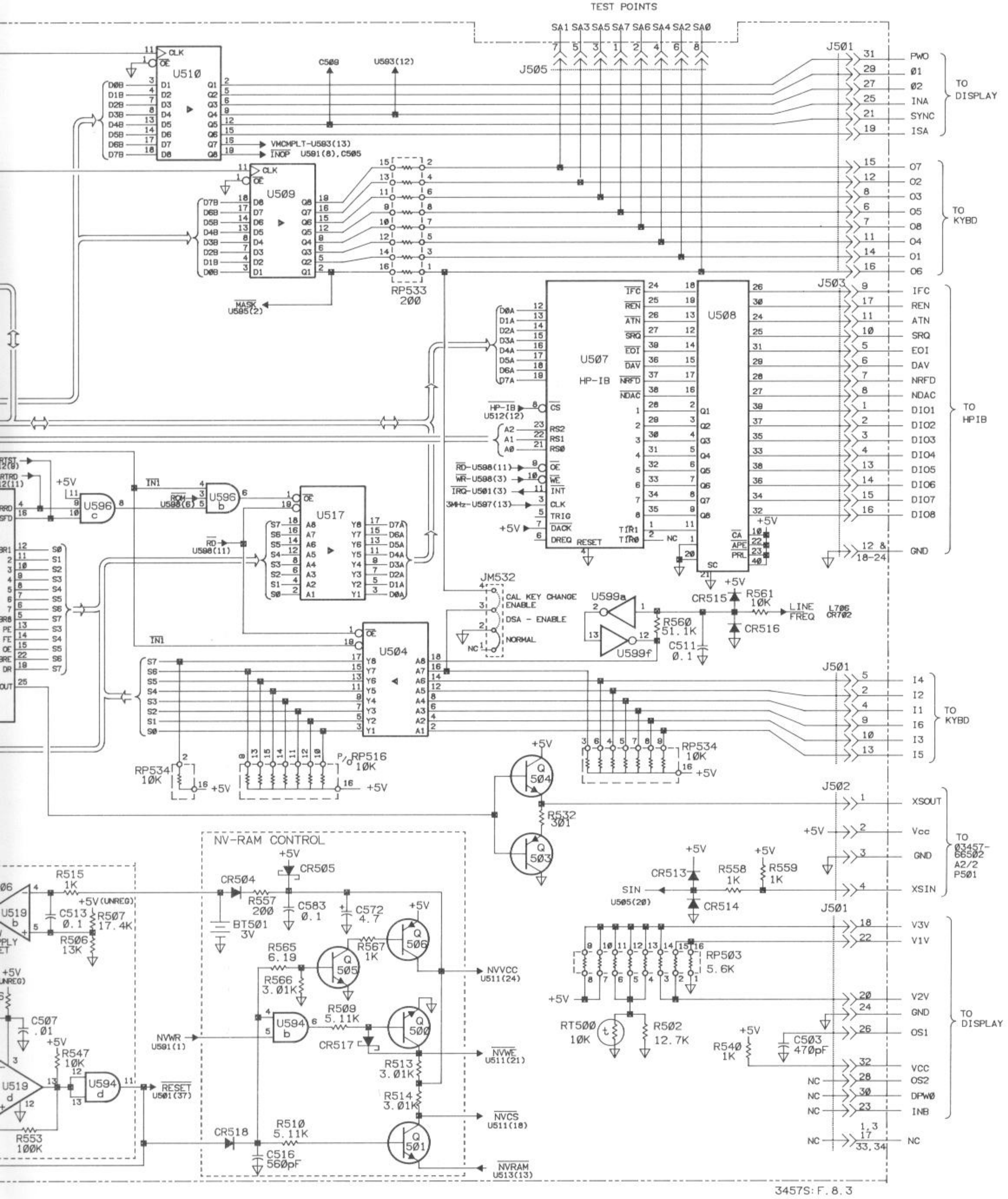
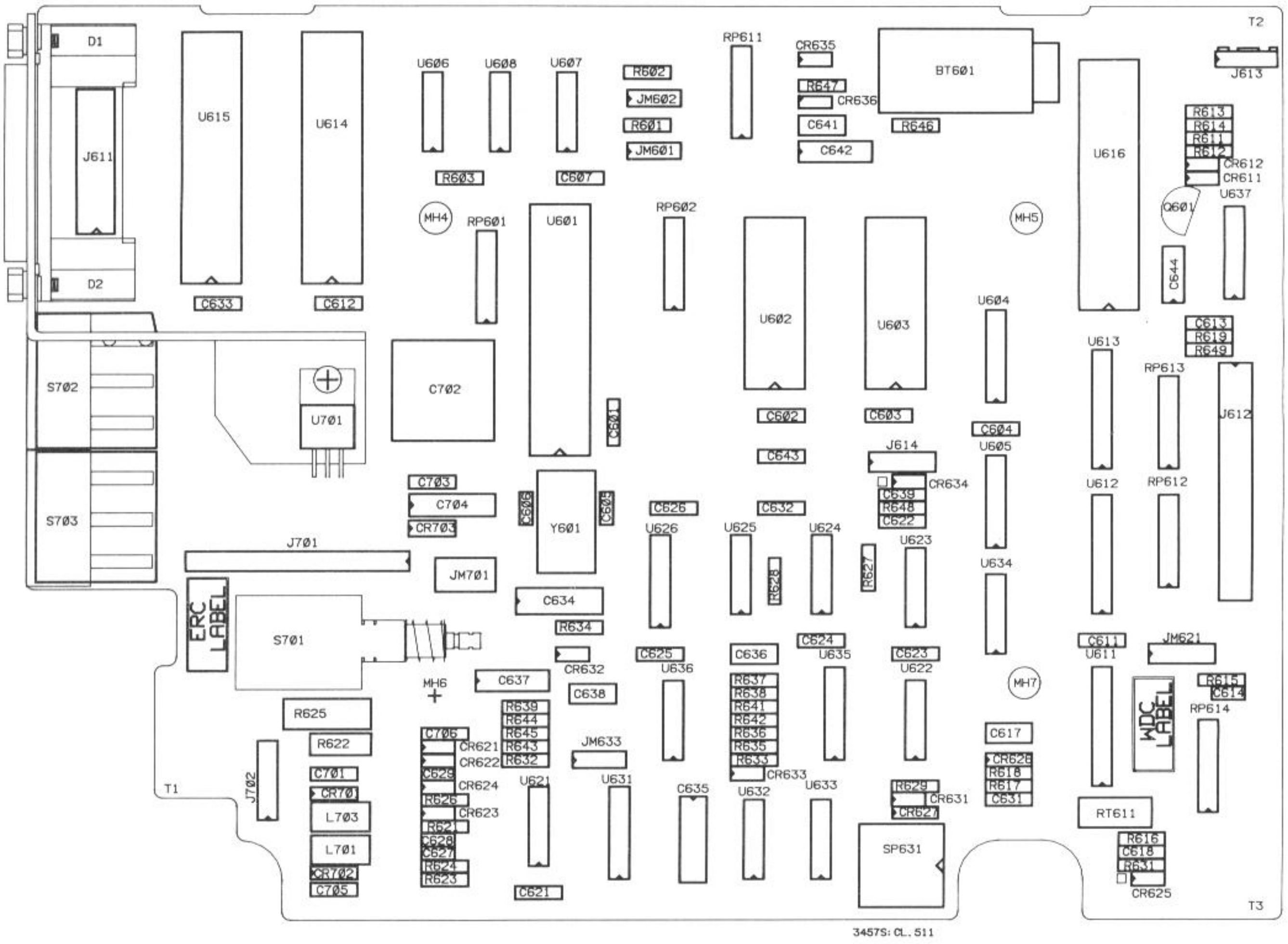
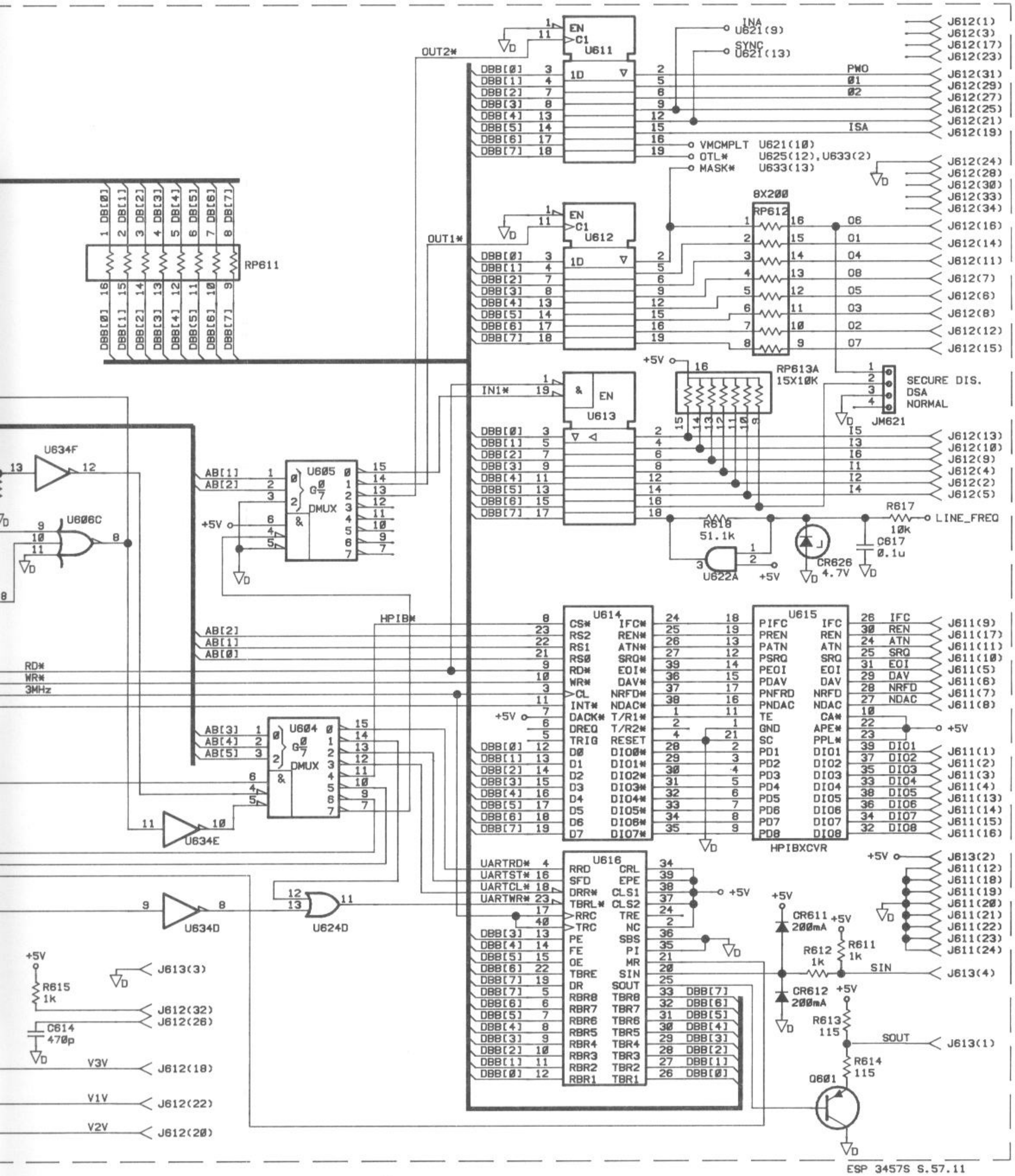

TEST POINTS
SA1 SA3 SA5 SA7 SA6 SA4 SA2 SA0
J505
J501
C508
U593(12)
U510
CLK
OE
D0B D1B D2B D3B D4B D5B D6B D7B
D1 D2 D3 D4 D5 D6 D7 D8
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8
VMCMPLT-U593(13)
INOP U591(8), C505
U509
MASK U585(2)
RP533 200
PWO
01
02
INA
SYNC
ISA
TO DISPLAY
O7 O2 O3 O5 O8 O4 O1 O6
TO KYBD
J503
IFC REN ATN SRQ EOI DAV NRFD NDAC
DIO1 DIO2 DIO3 DIO4 DIO5 DIO6 DIO7 DIO8
GND
12 & 18-24
TO HPIB
U507
HP-IB
U508
D0A D1A D2A D3A D4A D5A D6A D7A
HP-IB U512(12)
CS
A2 A1 A0
RS2 RS1 RS0
RD-U598(11)
WR-U598(3)
IRQ-U501(3)
3MHz-U597(13)
OE WE INT CLK TRIG DACK DREQ RESET
TIR1 TIR0
NC
CA APE PRL
SC
+5V
IN1
U596 c
U596 b
ROM U598(6)
RD U598(11)
U517
S7 S6 S5 S4 S3 S2 S1 S0
A8 A7 A6 A5 A4 A3 A2 A1
Y8 Y7 Y6 Y5 Y4 Y3 Y2 Y1
D7A D6A D5A D4A D3A D2A D1A D0A
JM532
CAL KEY CHANGE ENABLE
DSA - ENABLE
NORMAL
NC
U599a
U599f
R560 51.1K
C511 0.1
CR515
R561 10K
LINE FREQ
L706 CR702
CR516
U504
RP534 10K
P/O RP516 10K
I4 I2 I1 I6 I3 I5
TO KYBD
Q504
R532 301
Q503
J502
XSOUT
Vcc
GND
XSIN
TO 03457-66502 A2/2 P501
CR513
R558 1K
R559 1K
SIN
U505(20)
CR514
V3V
V1V
RP503 5.6K
RT500 10K
R502 12.7K
V2V
GND
OS1
R540 1K
C503 470pF
VCC
OS2
DPW0
INB
NC
1, 3 17 33, 34
TO DISPLAY
NV-RAM CONTROL
CR505
CR504
R557 200
C583 0.1
C572 4.7
BT501 3V
R565 6.19
R566 3.01K
Q505
R567 1K
Q506
NVVCC U511(24)
U594 b
NVWR U591(1)
R509 5.11K
Q500
CR517
NVWE U511(21)
R513 3.01K
R514 3.01K
NVCS U511(18)
CR518
R510 5.11K
C516 560pF
Q501
NVRAM U513(13)
R515 1K
+5V (UNREG)
U519 b
C513 0.1
R507 17.4K
R506 13K
C507 .01
R547 10K
U519 d
U594 d
RESET U501(37)
R553 100K
3457S: F. 8. 3

Figure 8-16. 03457-66501, Main Controller, Rev. A

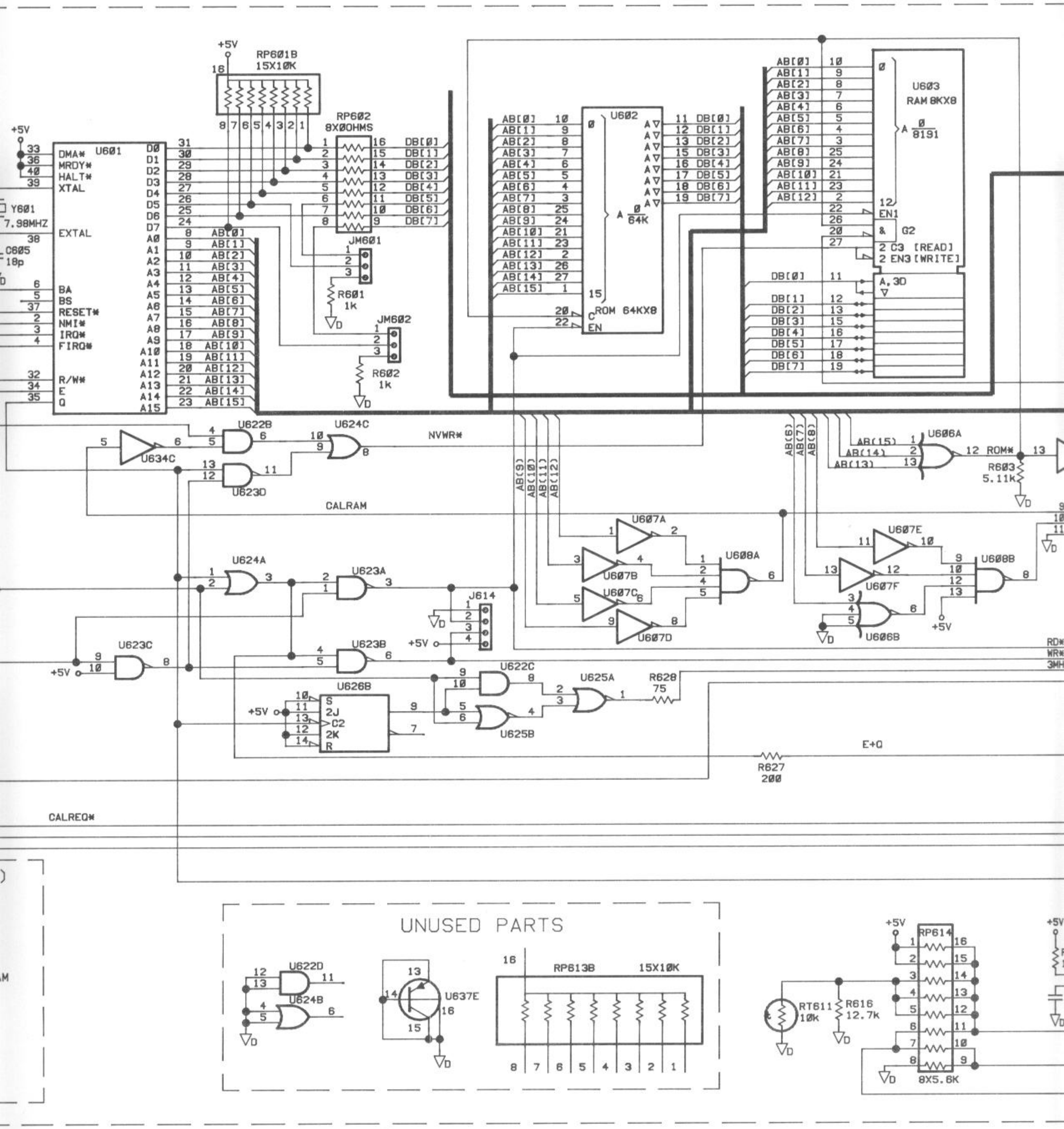

D1
J611
D2
U615
U614
U606
U608
U607
R602
JM602
R601
JM601
R603
C607
RP611
CR635
R647
CR636
C641
C642
BT601
R646
T2
J613
U616
R613
R614
R611
R612
CR612
CR611
U637
Q601
MH4
RP601
U601
RP602
MH5
C633
C612
U602
U603
U604
C644
C613
R619
R649
U613
RP613
J612
S702
U701
C702
C601
C602
C603
C604
U605
C643
J614
CR634
C639
R648
C622
U612
RP612
C703
C704
CR703
S703
C606
Y601
C605
C626
C632
U626
U625
U624
U623
R628
R627
U634
J701
JM701
ERC LABEL
C634
R634
S701
CR632
C625
U636
C636
C624
U635
C623
U622
C611
U611
JM621
MH6
C637
C638
R637
R638
R641
R642
R636
R635
R633
MH7
R615
C614
RP614
WDC LABEL
R625
R639
R644
R645
R643
R632
R622
C706
CR621
CR622
JM633
C617
CR628
R618
R617
C631
C701
CR701
C629
CR624
U621
U631
C635
U632
CR633
U633
R629
CR631
CR627
T1
J702
L703
R626
CR623
R621
C628
C627
R624
R623
L701
CR702
C705
C621
SP631
RT611
R616
C618
R631
CR625
T3
3457S: CL. 511

Component Locater. 03457-66511, Main Controller, Rev. A

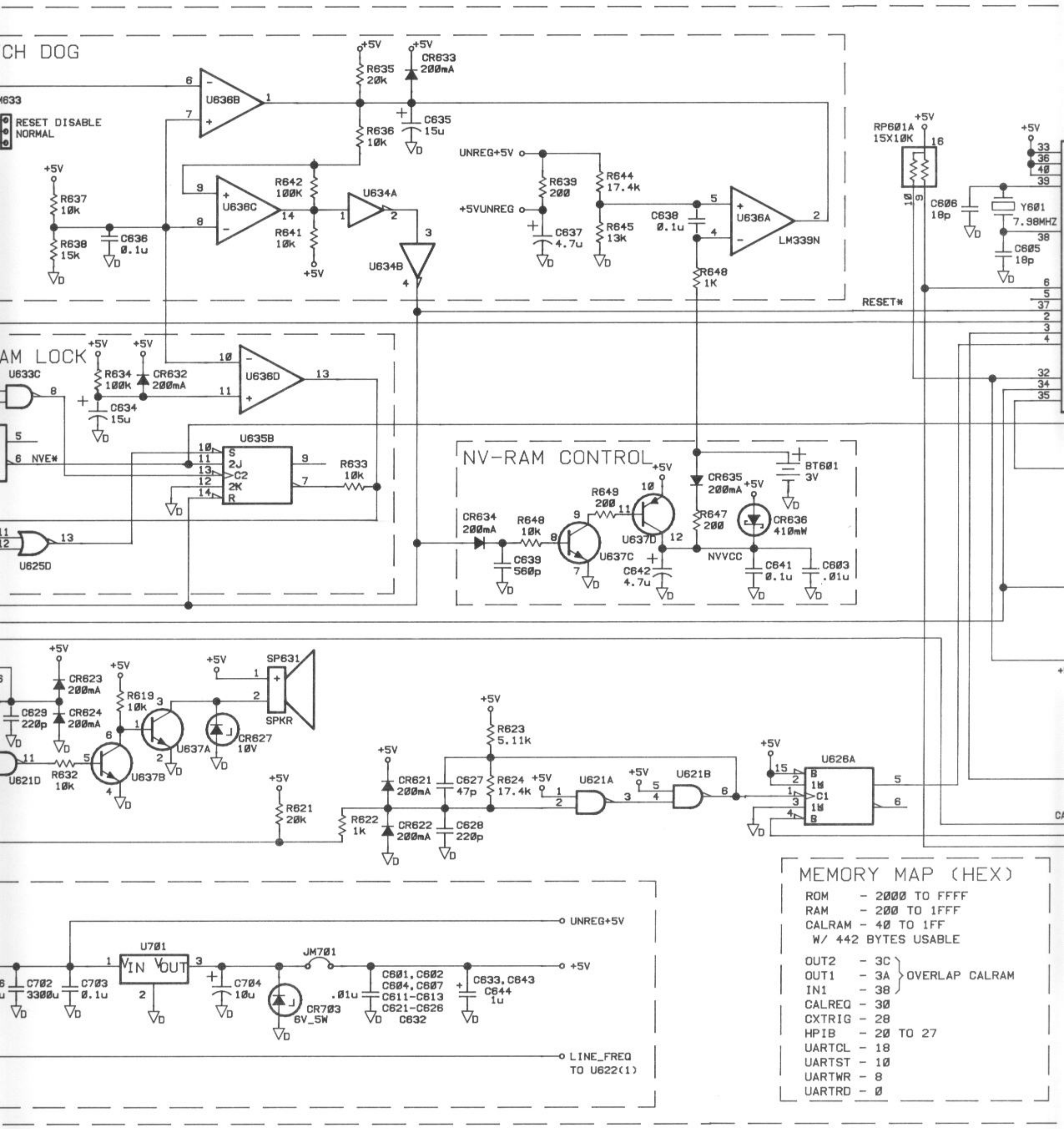


U611
EN
C1
1D
OUT2*
INA U621(9)
SYNC U621(13)
PWO
Ø1
Ø2
ISA
VMCMPLT U621(10)
OTL* U625(12),U633(2)
MASK* U633(13)
J612(1)
J612(3)
J612(17)
J612(23)
J612(31)
J612(29)
J612(27)
J612(25)
J612(21)
J612(19)
J612(24)
J612(28)
J612(30)
J612(33)
J612(34)
DBB[0]
DBB[1]
DBB[2]
DBB[3]
DBB[4]
DBB[5]
DBB[6]
DBB[7]
DB[0]
DB[1]
DB[2]
DB[3]
DB[4]
DB[5]
DB[6]
DB[7]
RP611
OUT1*
U612
8X200
RP612
O6
O1
O4
O8
O5
O3
O2
O7
J612(16)
J612(14)
J612(11)
J612(7)
J612(6)
J612(8)
J612(12)
J612(15)
+5V
RP613A
15X10K
SECURE DIS.
DSA
NORMAL
JM621
IN1*
U613
&
EN
I5
I3
I6
I1
I2
I4
J612(13)
J612(10)
J612(9)
J612(4)
J612(2)
J612(5)
R617
10K
LINE_FREQ
R618
51.1k
C617
0.1u
CR626
4.7V
U622A
U634F
U606C
U605
G 0/7
DMUX
AB[1]
AB[2]
HPIB*
AB[0]
RD*
WR*
3MHz
U614
CS*
RS2
RS1
RS0
CL
INT*
DACK*
DREQ
TRIG
D0
D1
D2
D3
D4
D5
D6
D7
IFC*
REN*
ATN*
SRQ*
EOI*
DAV*
NRFD*
NDAC*
T/R1*
T/R2*
RESET
DIO0*
DIO1*
DIO2*
DIO3*
DIO4*
DIO5*
DIO6*
DIO7*
U615
PIFC
PREN
PATN
PSRQ
PEOI
PDAV
PNFRD
PNDAC
TE
GND
SC
PD1
PD2
PD3
PD4
PD5
PD6
PD7
PD8
IFC
REN
ATN
SRQ
EOI
DAV
NRFD
NDAC
CA*
APE*
PPL*
DIO1
DIO2
DIO3
DIO4
DIO5
DIO6
DIO7
DIO8
HPIBXCVR
J611(9)
J611(17)
J611(11)
J611(10)
J611(5)
J611(6)
J611(7)
J611(8)
J611(1)
J611(2)
J611(3)
J611(4)
J611(13)
J611(14)
J611(15)
J611(16)
AB[3]
AB[4]
AB[5]
U604
U634E
U616
UARTRD*
UARTST*
UARTCL*
UARTWR*
RRD
SFD
DRR*
TBRL*
RRC
TRC
PE
FE
OE
TBRE
DR
RBR8
RBR7
RBR6
RBR5
RBR4
RBR3
RBR2
RBR1
CRL
EPE
CLS1
CLS2
TRE
NC
SBS
PI
MR
SIN
SOUT
TBR8
TBR7
TBR6
TBR5
TBR4
TBR3
TBR2
TBR1
U634D
U624D
J613(2)
J611(12)
J611(18)
J611(19)
J611(20)
J611(21)
J611(22)
J611(23)
J611(24)
CR611
200mA
R612
1k
R611
1k
CR612
200mA
J613(4)
R613
115
R614
115
SOUT
J613(1)
Q601
R615
1k
J613(3)
J612(32)
J612(26)
C614
470p
V3V
J612(18)
V1V
J612(22)
V2V
J612(20)
ESP 3457S S.57.11

Figure 8-17. 03457-66511, Main Controller, Rev. A



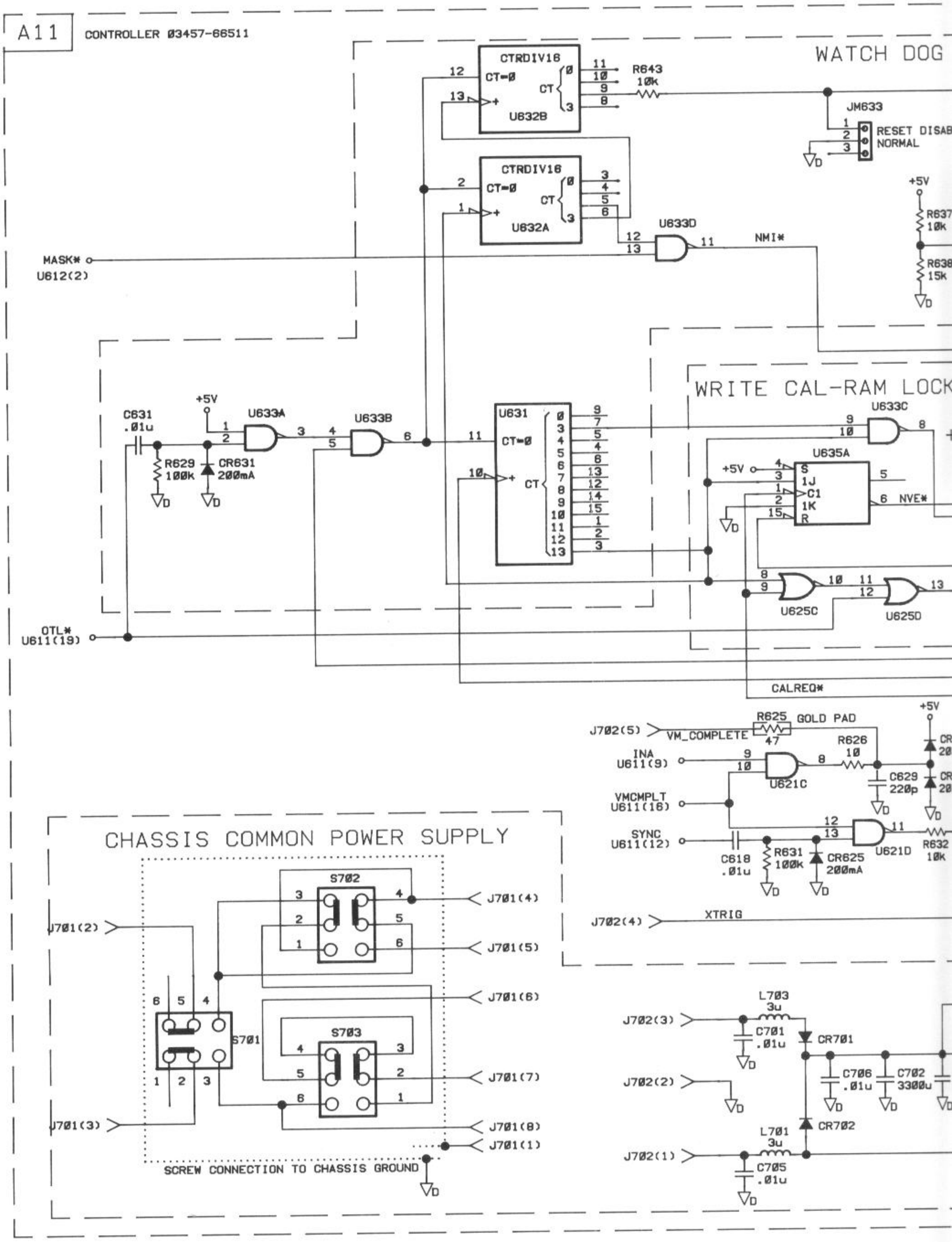
U601
DMA*
MRDY*
HALT*
XTAL
EXTAL
Y601
7.98MHZ
C605
18p
BA
BS
RESET*
NMI*
IRQ*
FIRQ*
R/W*
E
Q
+5V
RP601B
15X10K
RP602
8X0OHMS
JM601
JM602
R601
1k
R602
1k
U602
ROM 64KX8
A 0/64K
U603
RAM 8KX8
A 0/8191
EN1
G2
2 C3 [READ]
2 EN3 [WRITE]
A, 3D
AB[0]
AB[1]
AB[2]
AB[3]
AB[4]
AB[5]
AB[6]
AB[7]
AB[8]
AB[9]
AB[10]
AB[11]
AB[12]
AB[13]
AB[14]
AB[15]
DB[0]
DB[1]
DB[2]
DB[3]
DB[4]
DB[5]
DB[6]
DB[7]
U622B
U624C
NVWR*
U634C
U623D
CALRAM
U606A
ROM*
R603
5.11K
U607A
U607B
U607C
U607D
U607E
U607F
U608A
U608B
U606B
U624A
U623A
J614
U623B
U623C
U622C
U625A
U625B
U626B
R628
75
R627
200
E+Q
CALREQ*
RD*
WR*
3MH
UNUSED PARTS
U622D
U624B
U637E
RP613B
15X10K
RT611
10K
R616
12.7K
RP614
8X5.6K


CH DOG
633
RESET DISABLE
NORMAL
U636B
R635 20k
CR633 200mA
C635 15u
R636 10k
R637 10k
R638 15k
C636 0.1u
U636C
R642 100K
R641 10k
U634A
U634B
UNREG+5V
+5VUNREG
R639 200
C637 4.7u
R644 17.4k
R645 13k
C638 0.1u
U636A
LM339N
R648 1K
RP601A 15X10K
C606 18p
Y601 7.98MHZ
C605 18p
RESET*
AM LOCK
U633C
R634 100k
CR632 200mA
C634 15u
U636D
U635B
NVE*
R633 10k
U625D
NV-RAM CONTROL
BT601 3V
CR635 200mA
R649 200
U637D
CR634 200mA
R648 10k
C639 560p
U637C
R647 200
CR636 410mW
C642 4.7u
NVVCC
C641 0.1u
C603 .01u
CR623 200mA
CR624 200mA
C629 220p
R619 10k
U637A
SP631
SPKR
CR627 10V
U621D
R632 10k
U637B
R621 20k
R622 1k
CR621 200mA
CR622 200mA
C627 47p
C628 220p
R623 5.11k
R624 17.4k
U621A
U621B
U626A
+5V
U701
VIN VOUT
C702 3300u
C703 0.1u
C704 10u
JM701
CR703 6V_5W
C601, C602
C604, C607
C611-C613
C621-C626
C632
.01u
C633, C643
C644
1u
UNREG+5V
LINE_FREQ
TO U622(1)

MEMORY MAP (HEX)

ROM - 2000 TO FFFF
RAM - 200 TO 1FFF
CALRAM - 40 TO 1FF
W/ 442 BYTES USABLE

OUT2 - 3C
OUT1 - 3A } OVERLAP CALRAM
IN1 - 38
CALREQ - 30
CXTRIG - 28
HPIB - 20 TO 27
UARTCL - 18
UARTST - 10
UARTWR - 8
UARTRD - 0


A11
CONTROLLER 03457-66511
WATCH DOG
CTRDIV16
CT=0
CT
U632B
U632A
R643
10k
JM633
RESET DISAB
NORMAL
+5V
R637
10k
R638
15k
U633D
NMI*
MASK*
U612(2)
WRITE CAL-RAM LOCK
C631
.01u
R629
100k
CR631
200mA
U633A
U633B
U631
U633C
U635A
NVE*
U625C
U625D
OTL*
U611(19)
CALREQ*
J702(5)
VM_COMPLETE
R625
47
GOLD PAD
R626
10
INA
U611(9)
U621C
C629
220p
VMCMPLT
U611(16)
SYNC
U611(12)
C618
.01u
R631
100k
CR625
200mA
U621D
R632
10K
J702(4)
XTRIG
CHASSIS COMMON POWER SUPPLY
S702
S703
S701
J701(4)
J701(5)
J701(6)
J701(7)
J701(8)
J701(1)
J701(2)
J701(3)
SCREW CONNECTION TO CHASSIS GROUND
J702(3)
L703
3u
C701
.01u
CR701
C706
.01u
C702
3300u
J702(2)
CR702
L701
3u
J702(1)
C705
.01u

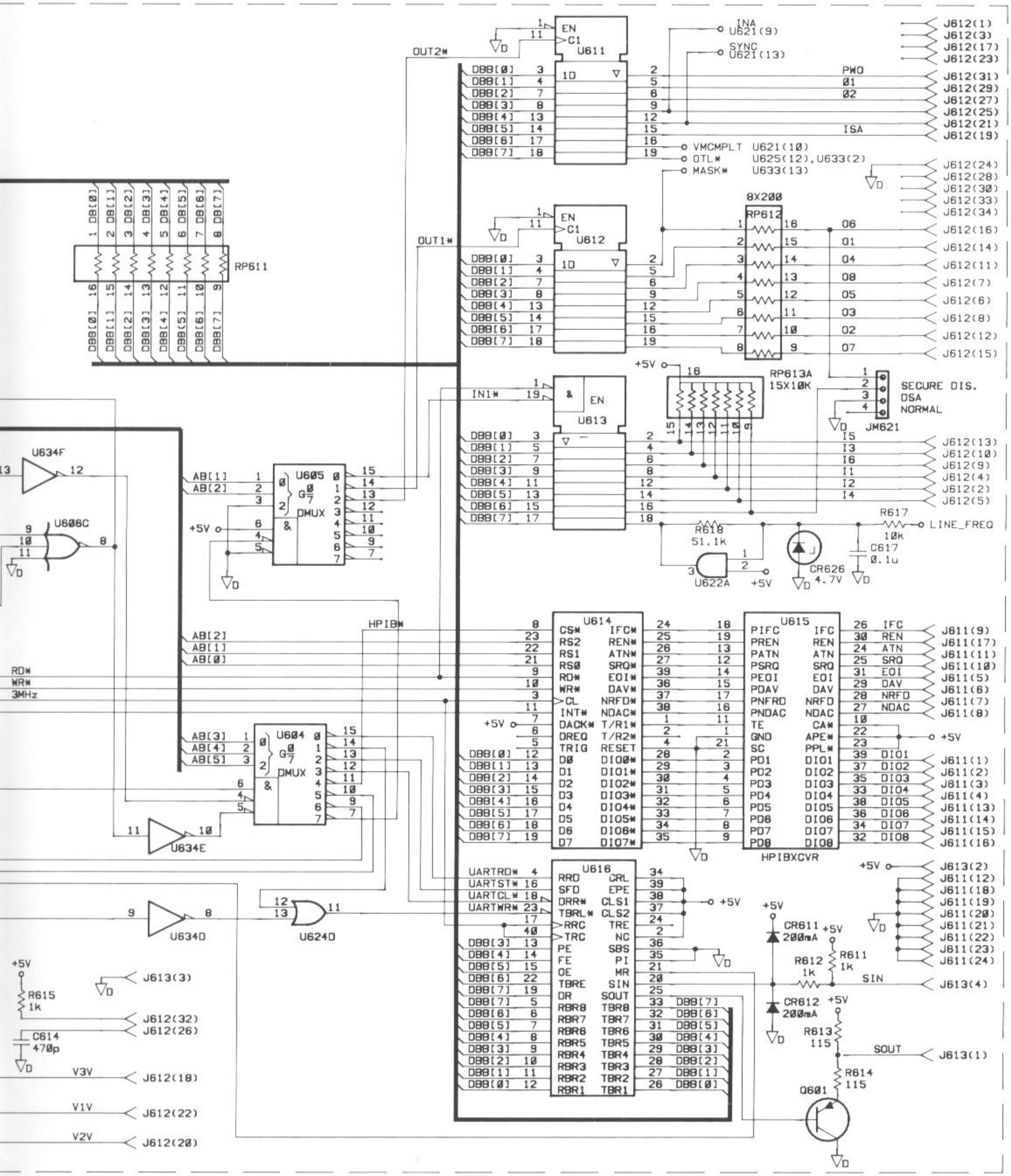
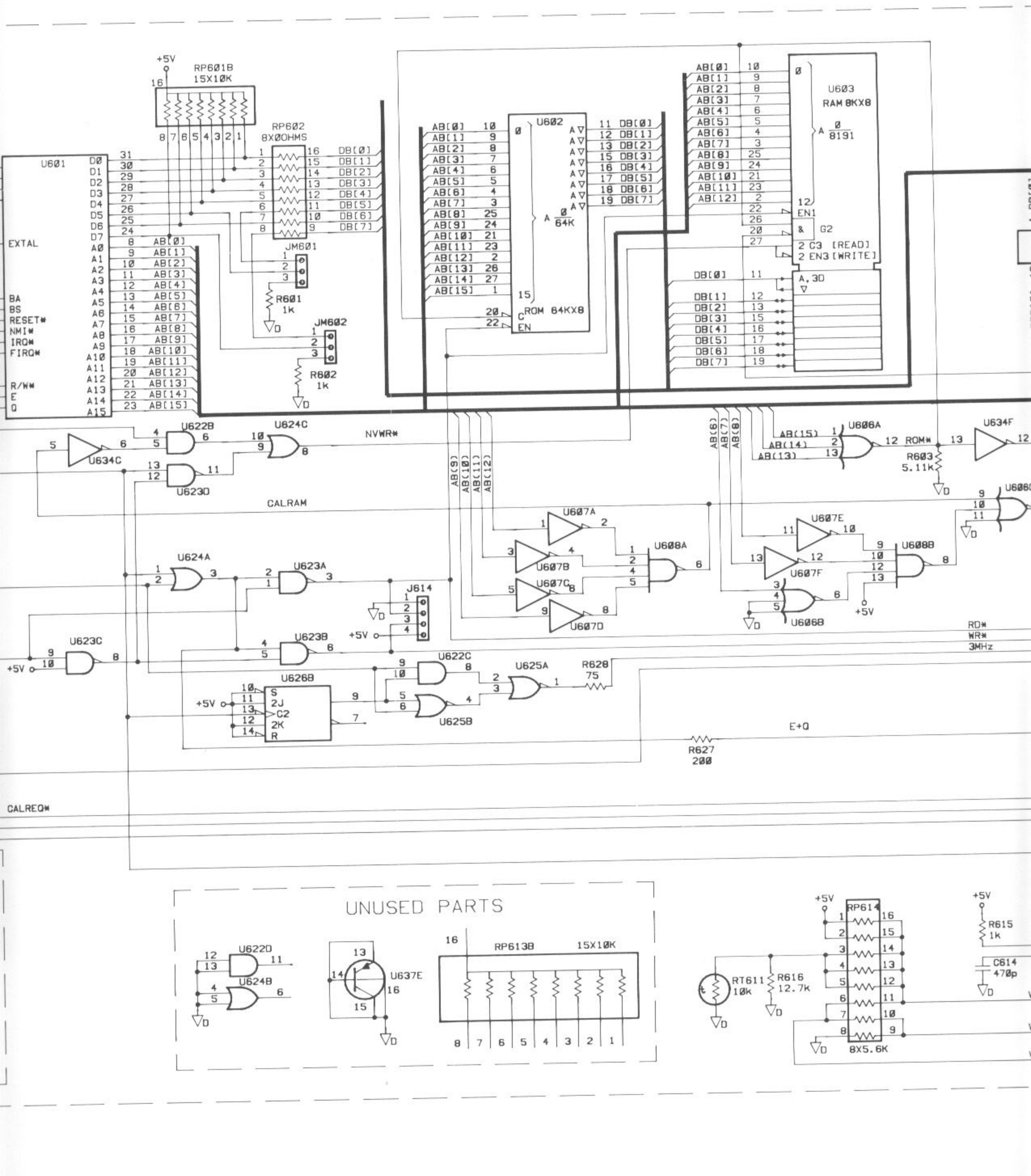
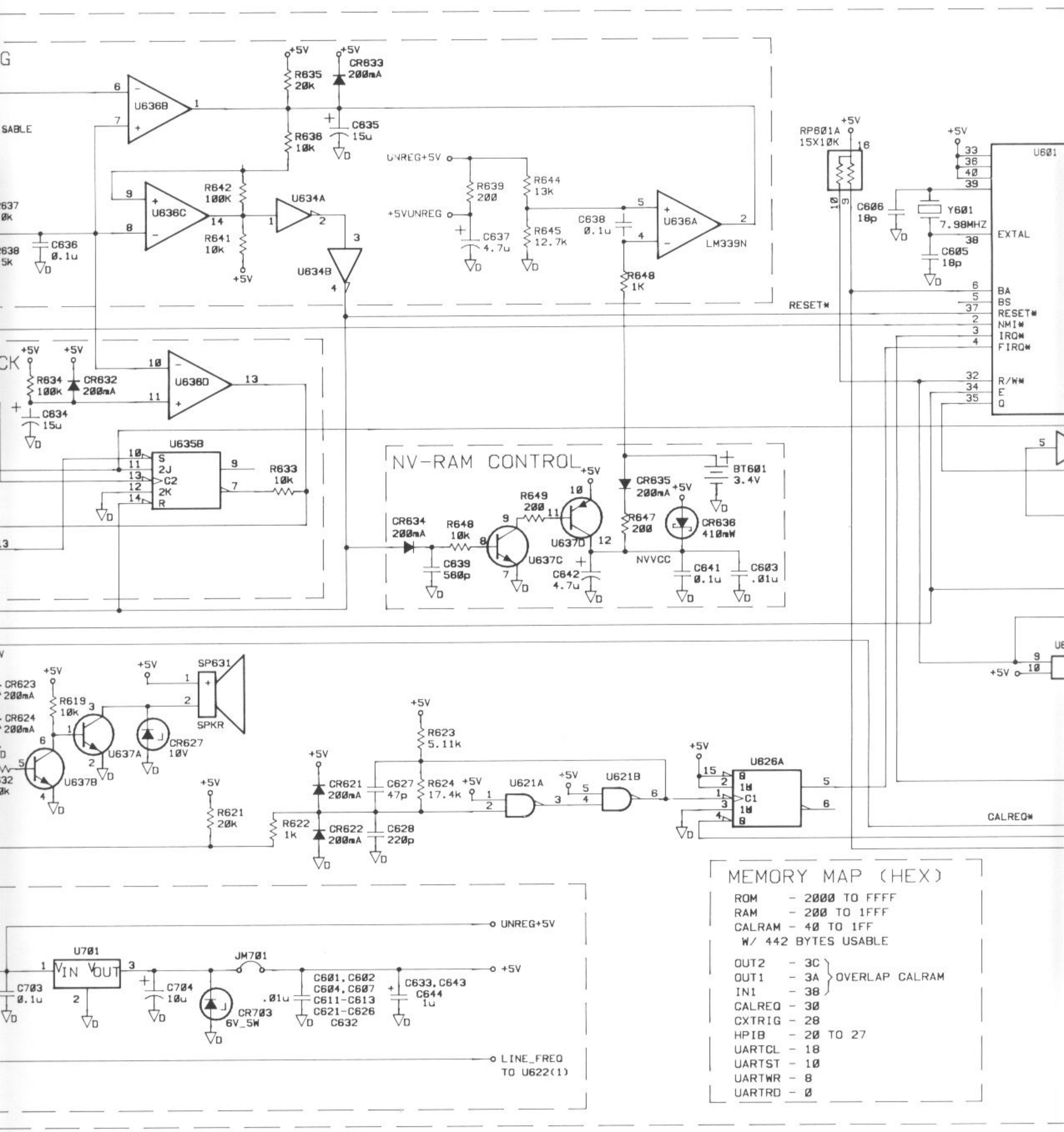

U611
U612
U613
RP611
RP612
8X200
RP613A
15X10K
JM621
SECURE DIS.
DSA
NORMAL
U605
U604
DMUX
U634F
U606C
U634E
U634D
U624D
U614
U615
HPIBXCVR
U616
U622A
CR626
4.7V
R617
10k
R618
51.1k
C617
0.1u
LINE_FREQ
CR611
200mA
CR612
200mA
R611
1k
R612
1k
R613
115
R614
115
Q601
R615
1k
C614
470p
OUT2*
OUT1*
IN1*
HPIB*
RD*
WR*
3MHz
+5V
SIN
SOUT
V3V
V1V
V2V
VMCMPLT
OTL*
MASK*
INA
SYNC
PWO
ISA
J611
J612
J613
ESP 3457S S.57.11a

Figure 8-17A. 03457-66511, ERC 2850, Main Controller, Rev. A



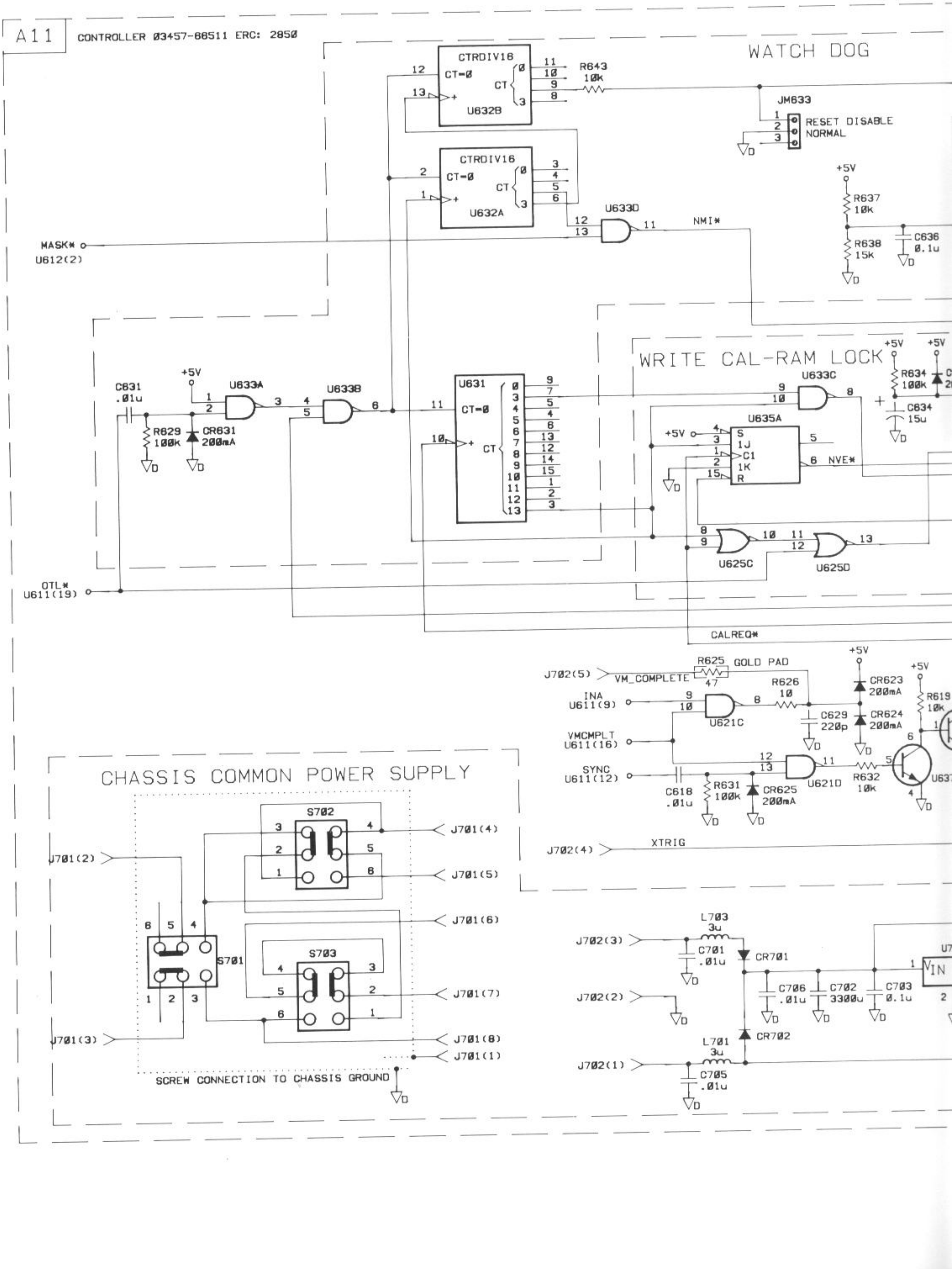
+5V
RP601B
15X10K
RP602
8X0OHMS
U601
D0
D1
D2
D3
D4
D5
D6
D7
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
EXTAL
BA
BS
RESET*
NMI*
IRQ*
FIRQ*
R/W*
E
Q
DB[0]
DB[1]
DB[2]
DB[3]
DB[4]
DB[5]
DB[6]
DB[7]
AB[0]
AB[1]
AB[2]
AB[3]
AB[4]
AB[5]
AB[6]
AB[7]
AB[8]
AB[9]
AB[10]
AB[11]
AB[12]
AB[13]
AB[14]
AB[15]
JM601
JM602
R601
1k
R602
1k
U602
ROM 64KX8
A 0/64K
U603
RAM 8KX8
A 0/8191
EN1
G2
2 C3 [READ]
2 EN3 [WRITE]
A,3D
U622B
U624C
NVWR*
U634C
U623D
CALRAM
U606A
ROM*
R603
5.11k
U634F
U606C
U607A
U607B
U607C
U607D
U608A
U607E
U607F
U608B
U606B
U624A
U623A
J614
U623C
U623B
U622C
U625A
U625B
U626B
S
2J
C2
2K
R
R628
75
RD*
WR*
3MHz
E+Q
R627
200
CALREQ*
UNUSED PARTS
U622D
U624B
U637E
RP613B
15X10K
RT611
10k
R616
12.7k
RP614
8X5.6K
R615
1k
C614
470p

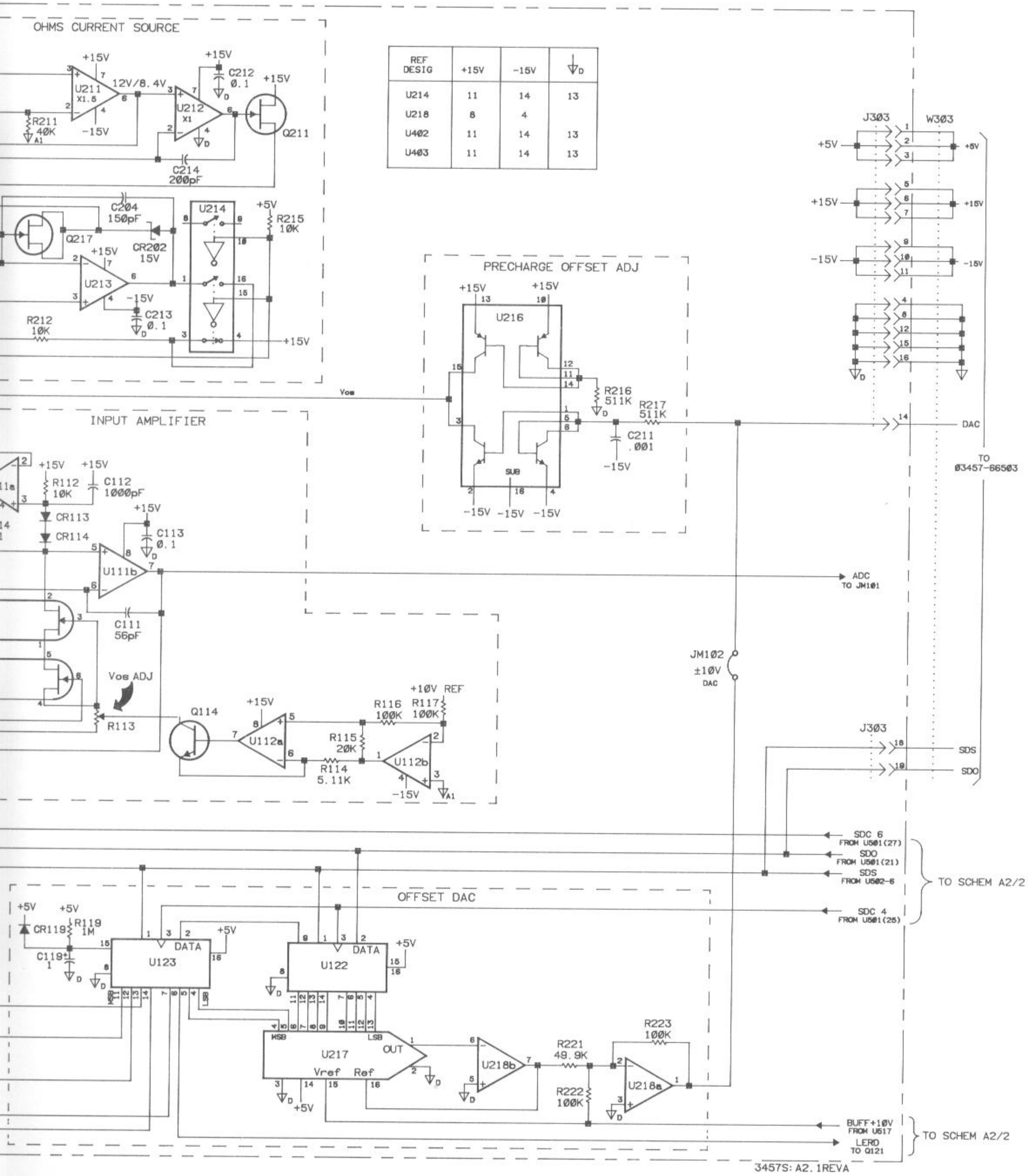

G
SABLE
U636B
R635 20K
CR833 200mA
C635 15u
R636 10K
R642 100K
R641 10K
U636C
U634A
U634B
637 0k
638 5k
C636 0.1u
UNREG+5V
+5VUNREG
R639 200
R644 13K
R645 12.7K
C637 4.7u
C638 0.1u
U636A
LM339N
R648 1K
RP601A 15X10K
C606 18p
Y601 7.98MHZ
C605 18p
U601
EXTAL
BA
BS
RESET*
NMI*
IRQ*
FIRQ*
R/W*
E
Q
CK
R634 100K
CR632 200mA
C634 15u
U636D
U635B
S
2J
C2
2K
R
R633 10k
NV-RAM CONTROL
CR634 200mA
R648 10k
C639 560p
R649 200
U637C
U637D
C642 4.7u
CR635 200mA
BT601 3.4V
R647 200
CR636 410mW
NVVCC
C641 0.1u
C603 .01u
CR623 200mA
CR624 200mA
R619 10k
U637A
U637B
CR627 10V
SP631
SPKR
R621 20k
R622 1k
CR621 200mA
CR622 200mA
C627 47p
C628 220p
R623 5.11k
R624 17.4k
U621A
U621B
U626A
CALREQ*
U701
VIN VOUT
C703 0.1u
C704 10u
CR703 6V_5W
JM701
C601, C602
C604, C607
C611-C613
C621-C626
C632
C633, C643
C644 1u
.01u
+5V
LINE_FREQ TO U622(1)

MEMORY MAP (HEX)

ROM - 2000 TO FFFF
RAM - 200 TO 1FFF
CALRAM - 40 TO 1FF
W/ 442 BYTES USABLE

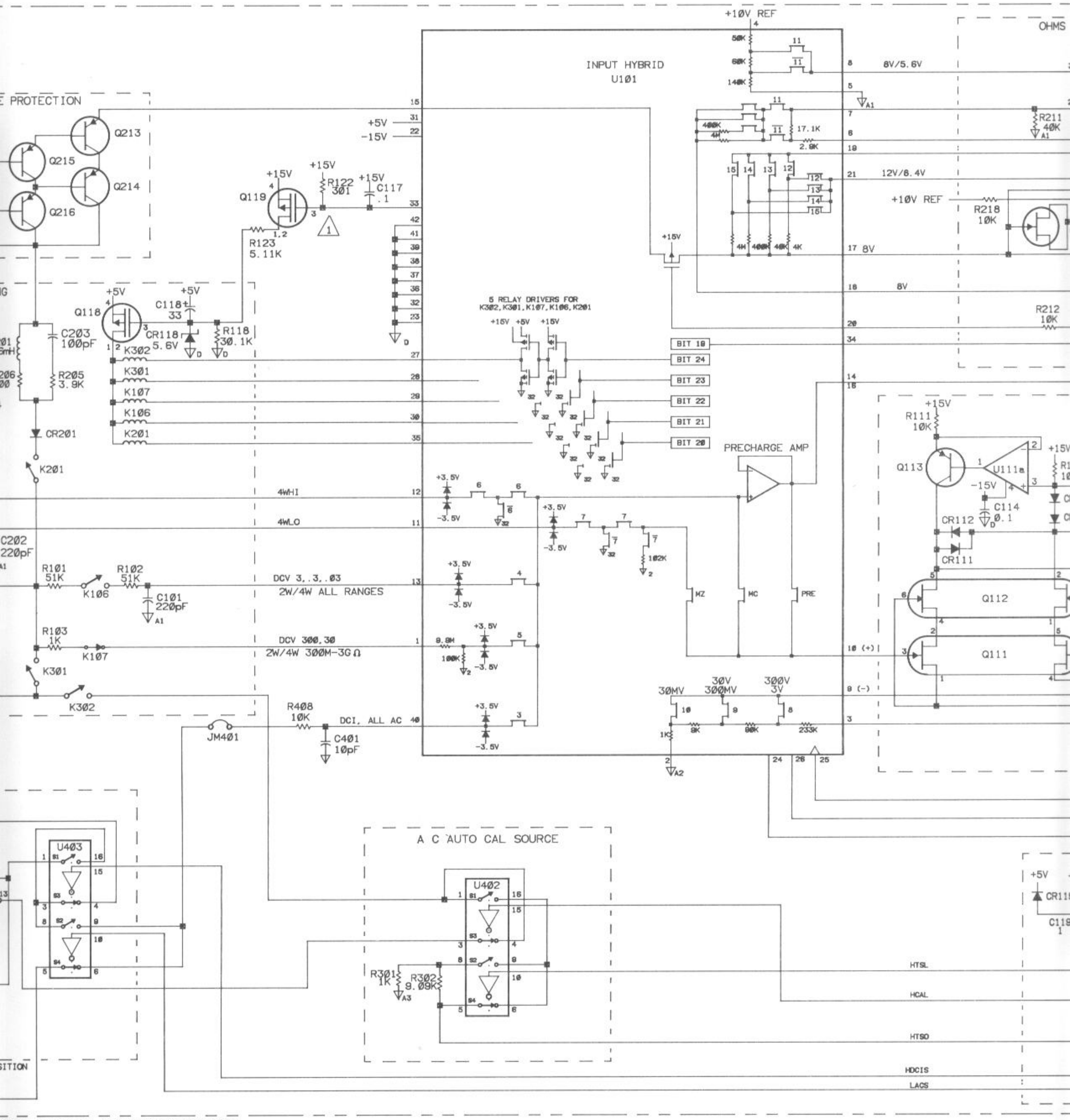
OUT2 - 3C
OUT1 - 3A } OVERLAP CALRAM
IN1 - 38
CALREQ - 30
CXTRIG - 28
HPIB - 20 TO 27
UARTCL - 18
UARTST - 10
UARTWR - 8
UARTRD - 0


A11
CONTROLLER 03457-66511 ERC: 2850
WATCH DOG
CTRDIV16
CT=0
CT
U632B
U632A
R643
10K
JM633
RESET DISABLE
NORMAL
+5V
R637
10K
R638
15K
C636
0.1u
U633D
NMI*
MASK*
U612(2)
WRITE CAL-RAM LOCK
C631
.01u
R629
100K
CR631
200mA
U633A
U633B
U631
U633C
R634
100K
C634
15u
U635A
NVE*
U625C
U625D
OTL*
U611(19)
CALREQ*
J702(5)
VM_COMPLETE
R625
47
GOLD PAD
R626
10
CR623
200mA
CR624
200mA
R619
10K
INA
U611(9)
U621C
C629
220p
VMCMPLT
U611(16)
SYNC
U611(12)
C618
.01u
R631
100K
CR625
200mA
U621D
R632
10K
J702(4)
XTRIG
CHASSIS COMMON POWER SUPPLY
S702
S701
S703
J701(2)
J701(3)
J701(4)
J701(5)
J701(6)
J701(7)
J701(8)
J701(1)
SCREW CONNECTION TO CHASSIS GROUND
J702(3)
L703
3u
C701
.01u
CR701
J702(2)
C706
.01u
C702
3300u
C703
0.1u
IN
J702(1)
L701
3u
C705
.01u
CR702


OHMS CURRENT SOURCE
+15V
U211
X1.5
12V/8.4V
-15V
R211
40K
A1
+15V
C212
0.1
+15V
U212
X1
Q211
C214
200pF
C204
150pF
Q217
CR202
15V
+15V
U213
-15V
C213
0.1
R212
10K
U214
+5V
R215
10K
+15V
Vos
PRECHARGE OFFSET ADJ
+15V
+15V
U216
SUB
-15V
-15V
-15V
R216
511K
R217
511K
C211
.001
-15V
INPUT AMPLIFIER
+15V
+15V
R112
10K
C112
1000pF
CR113
CR114
+15V
C113
0.1
U111b
C111
56pF
Vos ADJ
R113
Q114
+15V
U112a
R116
100K
+10V REF
R117
100K
R115
20K
R114
5.11K
U112b
-15V
A1
ADC
TO JM101
JM102
±10V
DAC
J303
W303
+5V
+5V
+15V
+15V
-15V
-15V
DAC
TO
03457-66503
J303
SDS
SDO
SDC 6
FROM U501(27)
SDO
FROM U501(21)
SDS
FROM U502-6
TO SCHEM A2/2
SDC 4
FROM U501(25)
OFFSET DAC
+5V
+5V
CR119
R119
1M
C119
1
U123
DATA
+5V
U122
DATA
+5V
MSB
LSB
U217
OUT
Vref
Ref
+5V
U218b
R221
49.9K
R223
100K
R222
100K
U218a
BUFF+10V
FROM U517
LERD
TO Q121
TO SCHEM A2/2
3457S: A2.1REVA

REF DESIG	+15V	-15V	⏚D
U214	11	14	13
U218	8	4	
U402	11	14	13
U403	11	14	13

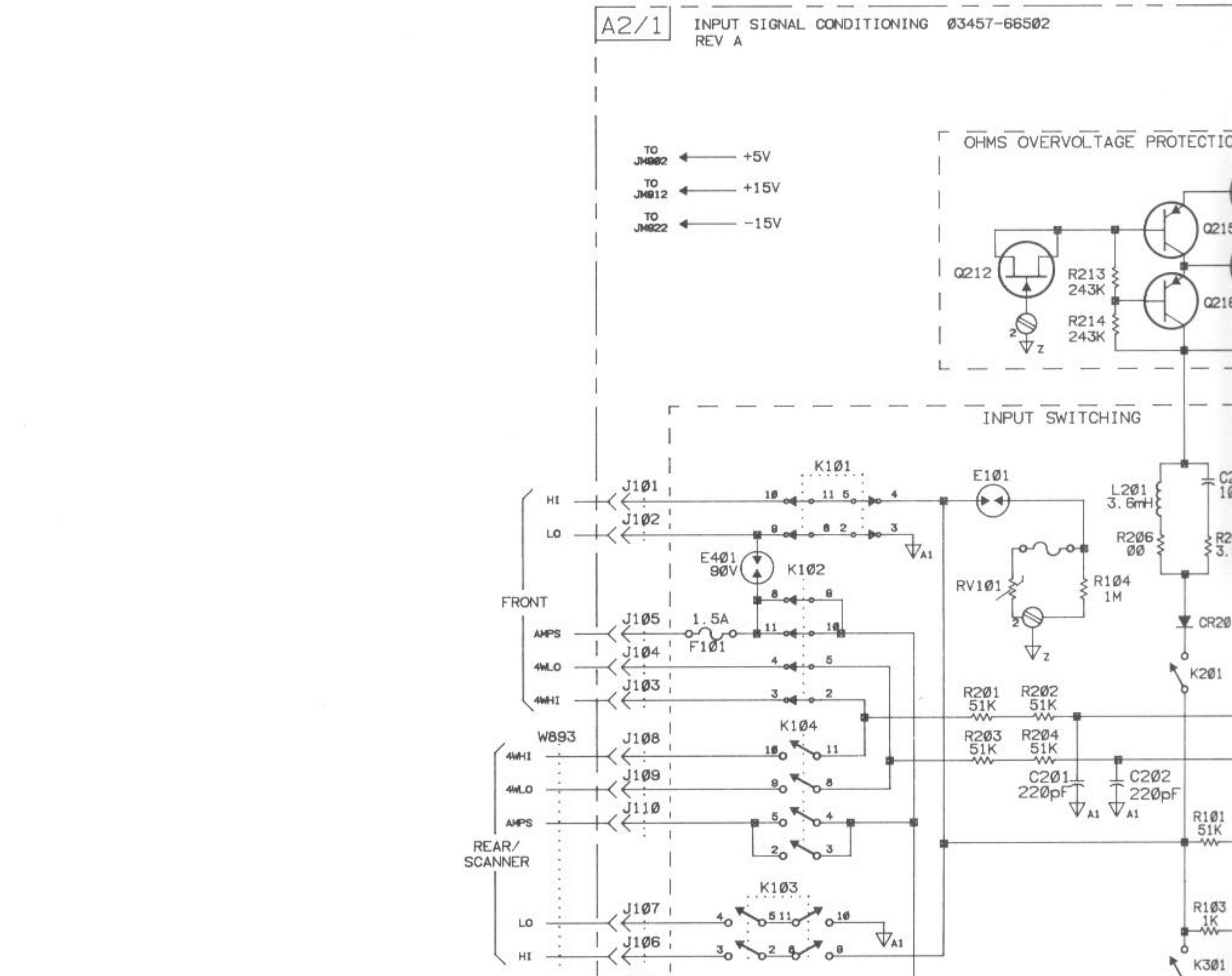
Figure 8-18. 03457-66502 (A2/1), Input Signal Conditioning, Rev. A



+10V REF
INPUT HYBRID
U101
E PROTECTION
Q213
Q215
Q214
Q216
+5V
-15V
+15V
Q119
R122
301
C117
.1
R123
5.11K
Q118
C118
33
CR118
5.6V
R118
30.1K
K302
K301
K107
K106
K201
C203
100pF
R205
3.9K
CR201
K201
5 RELAY DRIVERS FOR K302, K301, K107, K106, K201
BIT 19
BIT 24
BIT 23
BIT 22
BIT 21
BIT 20
PRECHARGE AMP
4WHI
4WLO
C202
220pF
R101
51K
R102
51K
K106
C101
220pF
DCV 3, .3, .03
2W/4W ALL RANGES
R103
1K
K107
DCV 300, 30
2W/4W 300M-3G Ω
K301
K302
R408
10K
DCI, ALL AC
C401
10pF
JM401
9.9M
100K
102K
MZ
MC
PRE
30MV
30V
300MV
300V
3V
1K
9K
90K
233K
50K
60K
140K
400K
4M
17.1K
2.9K
4M
400K
40K
4K
8V/5.6V
12V/8.4V
8V
OHMS
R211
40K
R218
10K
R212
10K
R111
10K
Q113
U111a
C114
0.1
CR112
CR111
Q112
Q111
10 (+)
9 (-)
U403
U402
A C AUTO CAL SOURCE
R301
1K
R302
9.09K
HTSL
HCAL
HTSO
HDCIS
LACS
SITION
+5V
CR11
C11

-0284, RF 150 Ω ; EFFECTIVE ON ERC 2529
ND CHANGING TO 150 Ω WHEN BOARD IS REPAIRED.

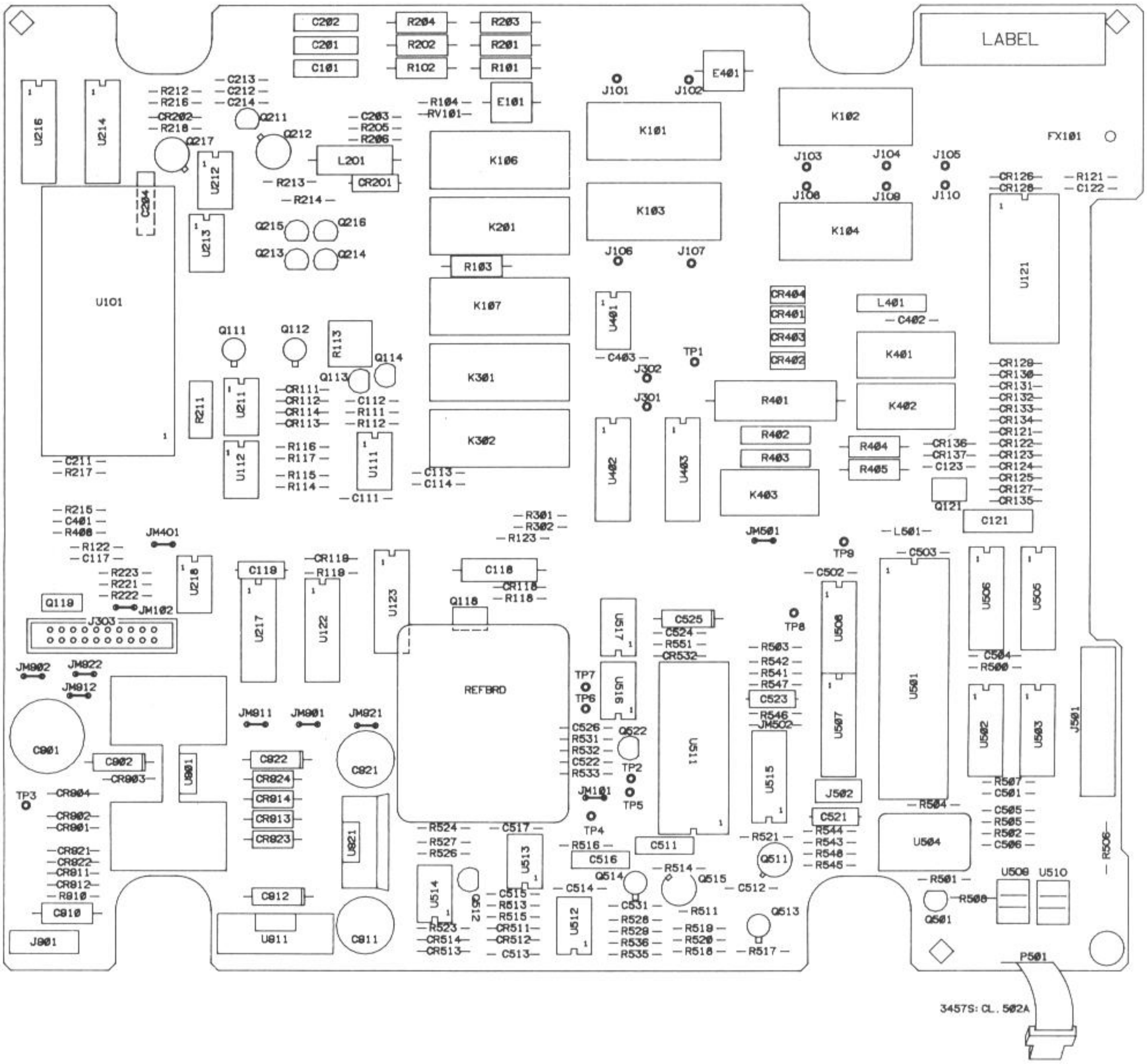
A2/1 INPUT SIGNAL CONDITIONING 03457-66502
REV A



TO JM002 +5V
TO JM012 +15V
TO JM022 -15V
OHMS OVERVOLTAGE PROTECTIO
Q212
R213 243K
R214 243K
Q215
Q216
INPUT SWITCHING
K101
E101
L201 3.6mH
R206 00
RV101
R104 1M
CR20
K201
J101 HI
J102 LO
E401 90V
K102
FRONT
J105 AMPS
1.5A F101
J104 4WLO
J103 4WHI
R201 51K
R202 51K
R203 51K
R204 51K
C201 220pF
C202 220pF
W893
J108 4WHI
J109 4WLO
J110 AMPS
K104
REAR/ SCANNER
R101 51K
K103
J107 LO
J106 HI
R103 1K
K301
J301 AC HI
J302 AC LO
AMPS
C403 0.1
C402 100p
L401 1uH
+15V
-15V
U401
K402
K403
R405 900
R404 90
R403 9
R402 1
CR401
CR402
CR403
CR404
K401
TP1
R401 0.1
TO 03457-66503
W303 VAC
J303

NOTE: ALL RELAYS SHOWN IN TURN-ON POSITION

⚠ R122 REPLACED BY 0757-0284, RF 150
AND ABOVE. RECOMMEND CHANGING


C202
C201
C101
R204
R202
R102
R203
R201
R101
LABEL
R212
R216
CR202
R218
C213
C212
C214
Q211
Q212
Q217
C203
R205
R206
R104
RV101
E101
J101
J102
E401
K101
K102
FX101
U216
U214
U212
L201
R213
CR201
R214
K106
J103
J104
J105
J108
J109
J110
CR126
CR128
R121
C122
C204
U213
Q215
Q216
Q213
Q214
K201
K103
K104
J106
J107
R103
U101
K107
CR404
CR401
CR403
CR402
U401
L401
C402
U121
Q111
Q112
R113
Q114
Q113
K301
C403
TP1
J302
K401
CR129
CR130
CR131
CR132
CR133
CR134
CR121
CR122
CR123
CR124
CR125
CR127
CR135
R211
U211
CR111
CR112
CR114
CR113
C112
R111
R112
J301
R401
K402
U112
R116
R117
R115
R114
U111
K302
R402
R403
R404
R405
CR136
CR137
C123
U402
U403
K403
Q121
C211
R217
C113
C114
C111
R215
C401
R406
R301
R302
R123
C121
JM401
R122
C117
R223
R221
R222
U218
C119
CR119
R119
U123
C118
CR118
R118
JM501
L501
TP9
C503
C502
Q119
JM102
J303
U217
U122
Q118
U517
C525
C524
R551
CR532
TP8
U506
R503
R542
R541
R547
U508
U501
U506
U505
C504
R500
JM902
JM922
JM912
REFBRD
TP7
TP6
U516
C523
R546
JM502
U507
U502
U503
J501
JM911
JM901
JM921
C526
R531
R532
C522
R533
Q522
U511
U515
C901
C902
CR903
U901
C922
CR924
CR914
CR913
CR923
C921
TP2
TP3
CR904
CR902
CR901
JM101
TP5
TP4
J502
R507
C501
C505
R505
R502
C506
R504
C521
U504
CR921
CR922
CR911
CR912
R910
U921
R524
R527
R526
C517
U513
R516
C516
C511
R521
Q511
R544
R543
R548
R545
R506
C910
C912
U514
Q512
C515
R513
R515
CR511
CR512
C513
Q514
R514
Q515
C512
C514
U512
C531
R528
R529
R536
R535
R511
R519
R520
R518
R517
Q513
R501
R508
Q501
U509
U510
J901
U911
C911
R523
CR514
CR513
P501

3457S: CL. 502A

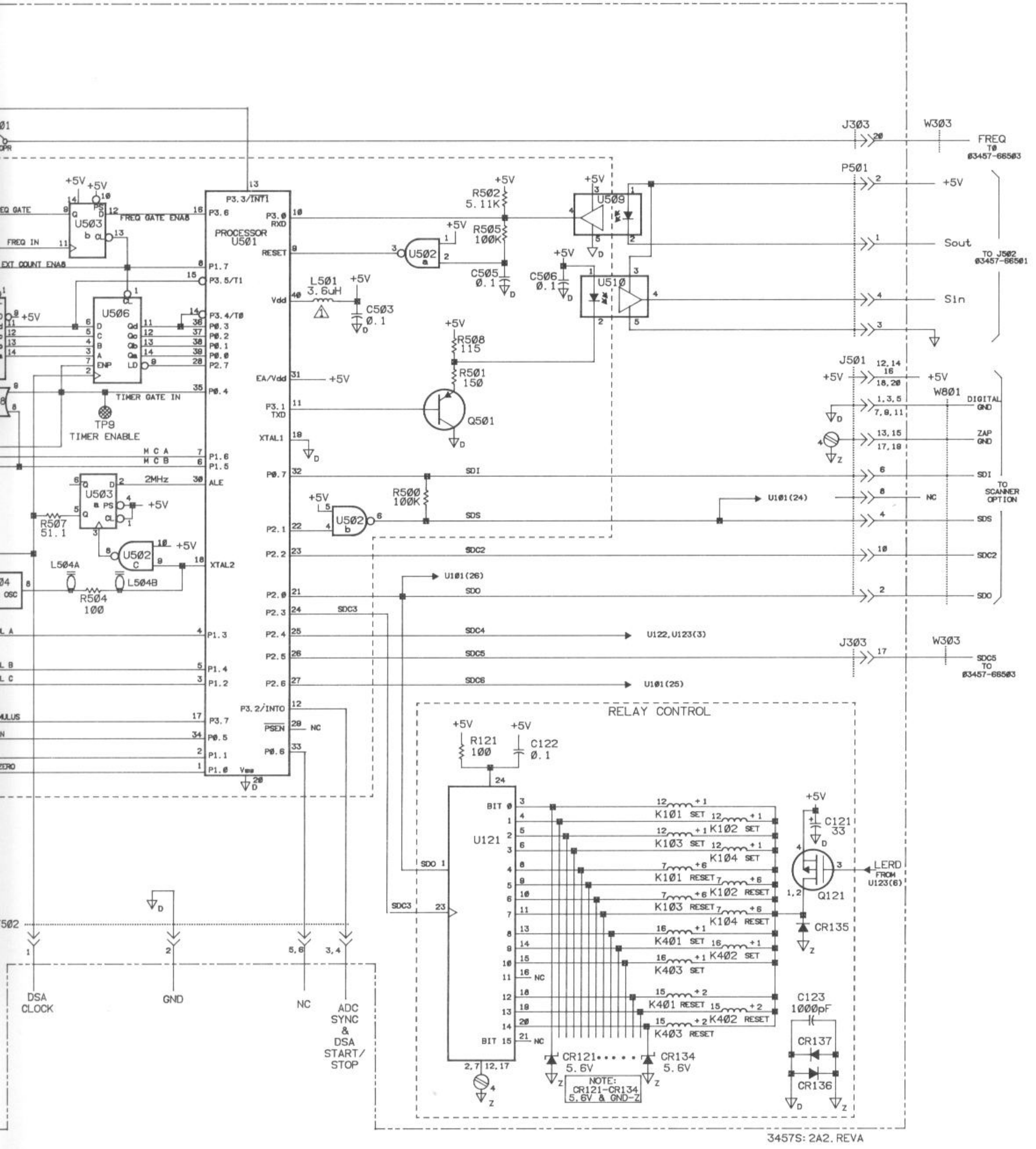
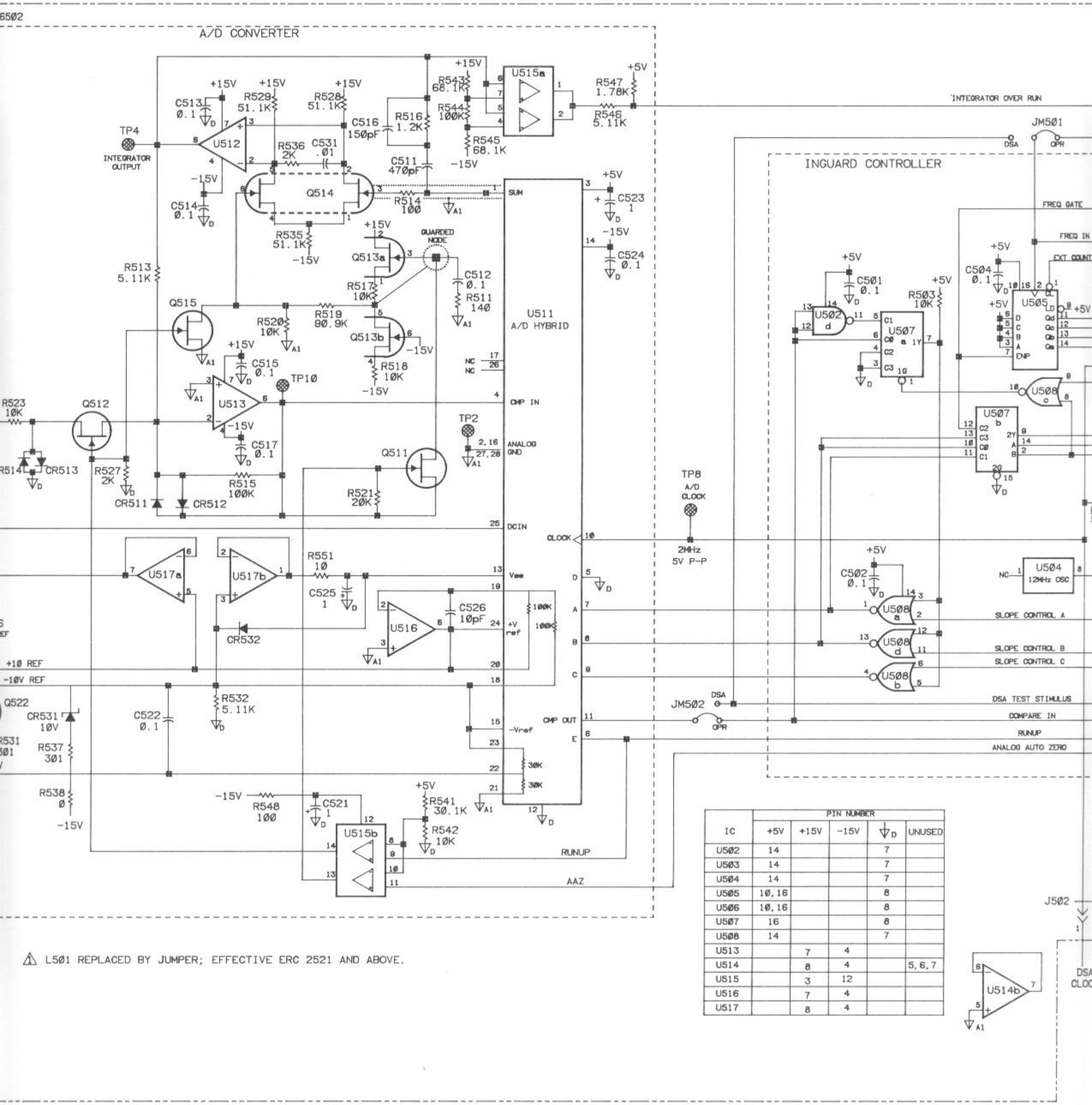
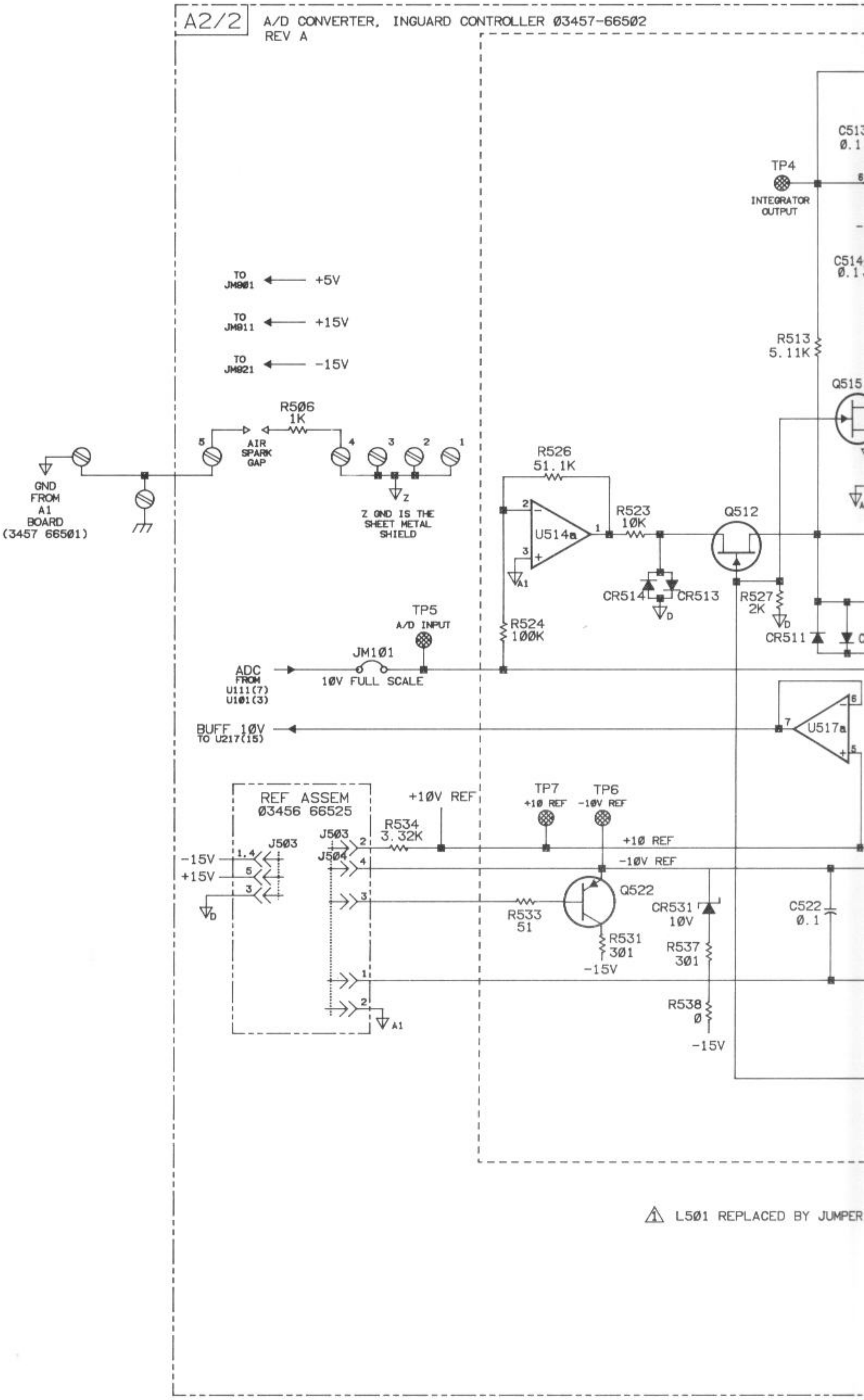

PROCESSOR U501
P3.3/INT1
P3.6
P3.0 RXD
RESET
P1.7
P3.5/T1
Vdd
P3.4/T0
P0.3
P0.2
P0.1
P0.0
P2.7
P0.4
EA/Vdd
P3.1 TXD
XTAL1
P1.6
P1.5
ALE
P0.7
P2.1
P2.2
XTAL2
P2.0
P2.3
P1.3
P2.4
P2.5
P1.4
P1.2
P2.6
P3.2/INTO
P3.7
PSEN
P0.5
P0.6
P1.1
P1.0
Vss
U503
FREQ GATE
FREQ GATE ENAB
FREQ IN
EXT COUNT ENAB
U506
TIMER GATE IN
TP9
TIMER ENABLE
M C A
M C B
2MHz
R507 51.1
U502 c
L504A
L504B
R504 100
OSC
+5V
L501 3.6uH
C503 0.1
R502 5.11K
R505 100K
U502 a
C505 0.1
C506 0.1
U509
U510
R508 115
R501 150
Q501
R500 100K
U502 b
SDI
SDS
SDC2
SDO
SDC3
SDC4
SDC5
SDC6
U101(24)
U101(26)
U122, U123(3)
U101(25)
NC
J303
W303
FREQ TO 03457-66503
P501
Sout
Sin
TO J502 03457-66501
J501
W801
DIGITAL GND
ZAP GND
TO SCANNER OPTION
SDC5 TO 03457-66503
RELAY CONTROL
R121 100
C122 0.1
U121
BIT 0
BIT 15
K101 SET
K102 SET
K103 SET
K104 SET
K101 RESET
K102 RESET
K103 RESET
K104 RESET
K401 SET
K402 SET
K403 SET
K401 RESET
K402 RESET
K403 RESET
C121 33
Q121
LERD FROM U123(6)
CR135
C123 1000pF
CR137
CR136
CR121 5.6V
CR134 5.6V
NOTE: CR121-CR134 5.6V & GND-Z
DSA CLOCK
GND
ADC SYNC & DSA START/STOP
3457S: 2A2. REVA

Figure 8-19. 03457-66502 (A2/2), A/D Converter, Inguard Controller, Rev. A


6502
A/D CONVERTER
INGUARD CONTROLLER
TP4
INTEGRATOR OUTPUT
U512
U513
U515a
U515b
U516
U517a
U517b
Q511
Q512
Q513a
Q513b
Q514
Q515
Q522
U511
A/D HYBRID
GUARDED NODE
TP10
TP2
TP8
A/D CLOCK
2MHz
5V P-P
R543 68.1K
R544 100K
R545 68.1K
R516 1.2K
C516 150pF
C511 470pF
R547 1.78K
R546 5.11K
R529 51.1K
R528 51.1K
R536 2K
C531 .01
C513 0.1
C514 0.1
R514 100
R535 51.1K
R513 5.11K
R517 10K
R518 10K
R511 140
C512 0.1
R520 10K
R519 90.9K
C515 0.1
C517 0.1
R515 100K
R523 10K
R527 2K
R521 20K
CR511
CR512
CR513
R514
C523 1
C524 0.1
R551 10
C525 1
C526 10pF
CR532
R532 5.11K
C522 0.1
CR531 10V
R531
R537 301
R538 0
R548 100
C521 1
R541 30.1K
R542 10K
+10 REF
-10V REF
SUM
CMP IN
ANALOG GND
DCIN
CLOCK
Vss
+V ref
-Vref
CMP OUT
NC
RUNUP
AAZ
INTEGRATOR OVER RUN
JM501
JM502
DSA
OPR
FREQ GATE
FREQ IN
EXT COUNT
U502 d
U507 a
U507 b
U505
U508 a
U508 b
U508 c
U508 d
U504 12MHz OSC
C501 0.1
C502 0.1
C504 0.1
R503 10K
SLOPE CONTROL A
SLOPE CONTROL B
SLOPE CONTROL C
DSA TEST STIMULUS
COMPARE IN
RUNUP
ANALOG AUTO ZERO
J502
U514b
DSA CLOC
+5V
+15V
-15V

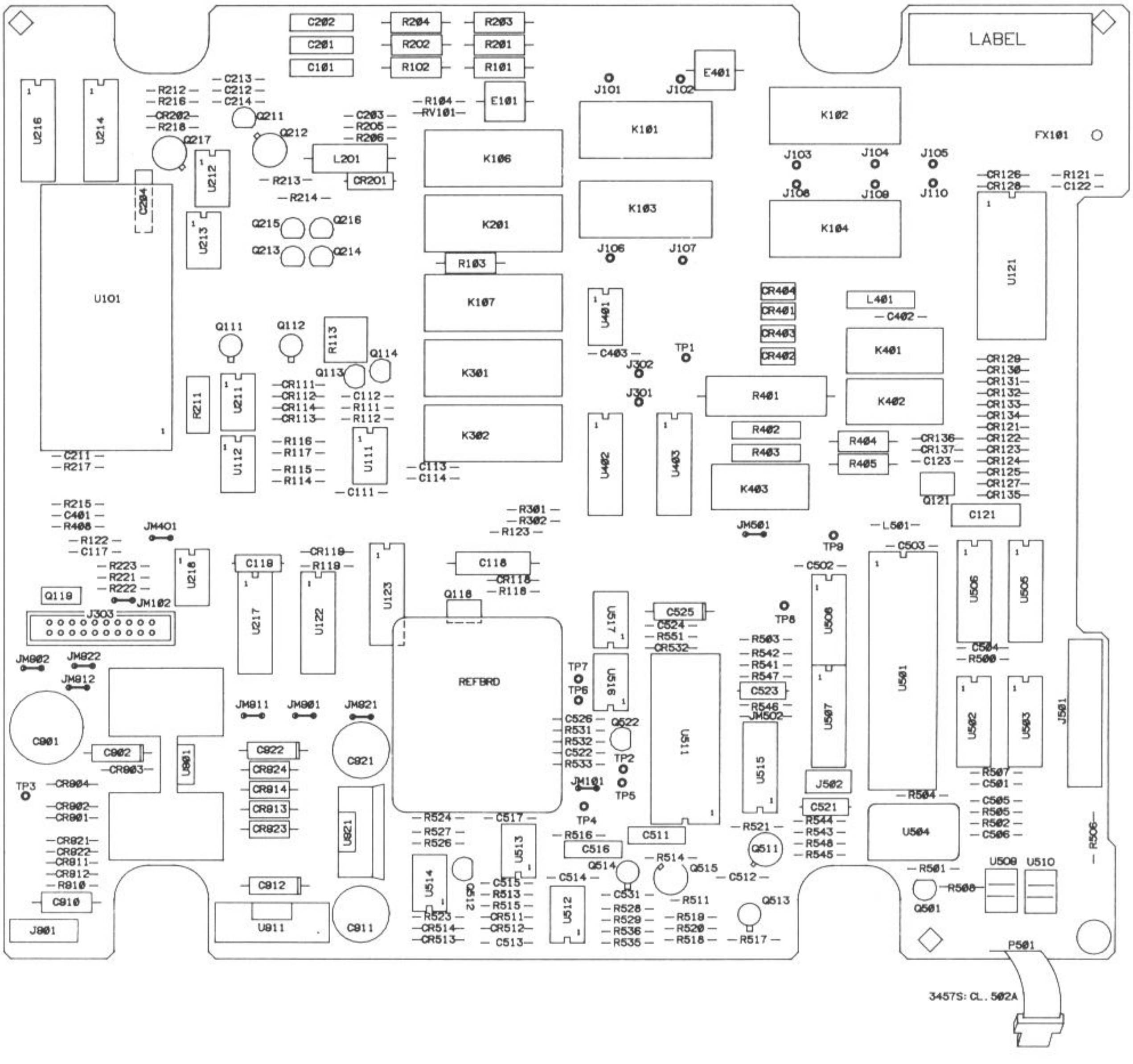
IC	PIN NUMBER				
	+5V	+15V	-15V	⏚D	UNUSED
U502	14			7	
U503	14			7	
U504	14			7	
U505	10, 16			8	
U506	10, 16			8	
U507	16			8	
U508	14			7	
U513		7	4		
U514		8	4		5, 6, 7
U515		3	12		
U516		7	4		
U517		8	4		

⚠ L501 REPLACED BY JUMPER; EFFECTIVE ERC 2521 AND ABOVE.

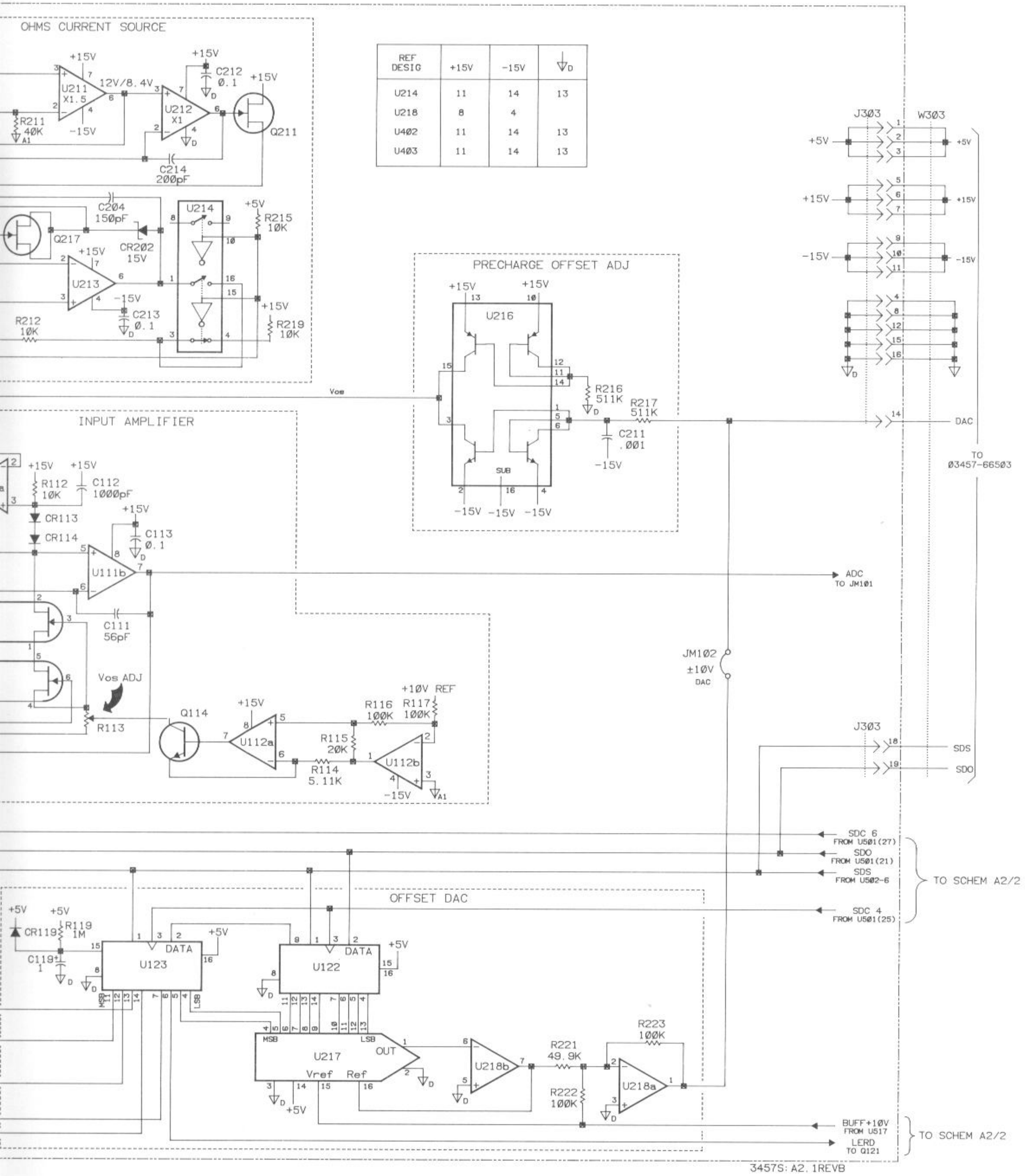

A2/2 A/D CONVERTER, INGUARD CONTROLLER 03457-66502
REV A

TO JM901 +5V
TO JM911 +15V
TO JM921 -15V
R506 1K
AIR SPARK GAP
5 4 3 2 1
Z GND IS THE SHEET METAL SHIELD
GND FROM A1 BOARD (3457 66501)
TP4
INTEGRATOR OUTPUT
C513 0.1
C514 0.1
R513 5.11K
Q515
R526 51.1K
U514a
R523 10K
Q512
CR514
CR513
R527 2K
CR511
R524 100K
TP5 A/D INPUT
JM101
10V FULL SCALE
ADC FROM U111(7) U101(3)
BUFF 10V TO U217(15)
U517a
REF ASSEM 03456 66525
J503
J504
-15V
+15V
+10V REF
R534 3.32K
TP7 +10 REF
TP6 -10V REF
+10 REF
-10V REF
Q522
R533 51
R531 301
-15V
CR531 10V
R537 301
R538 0
C522 0.1

⚠1 L501 REPLACED BY JUMPER

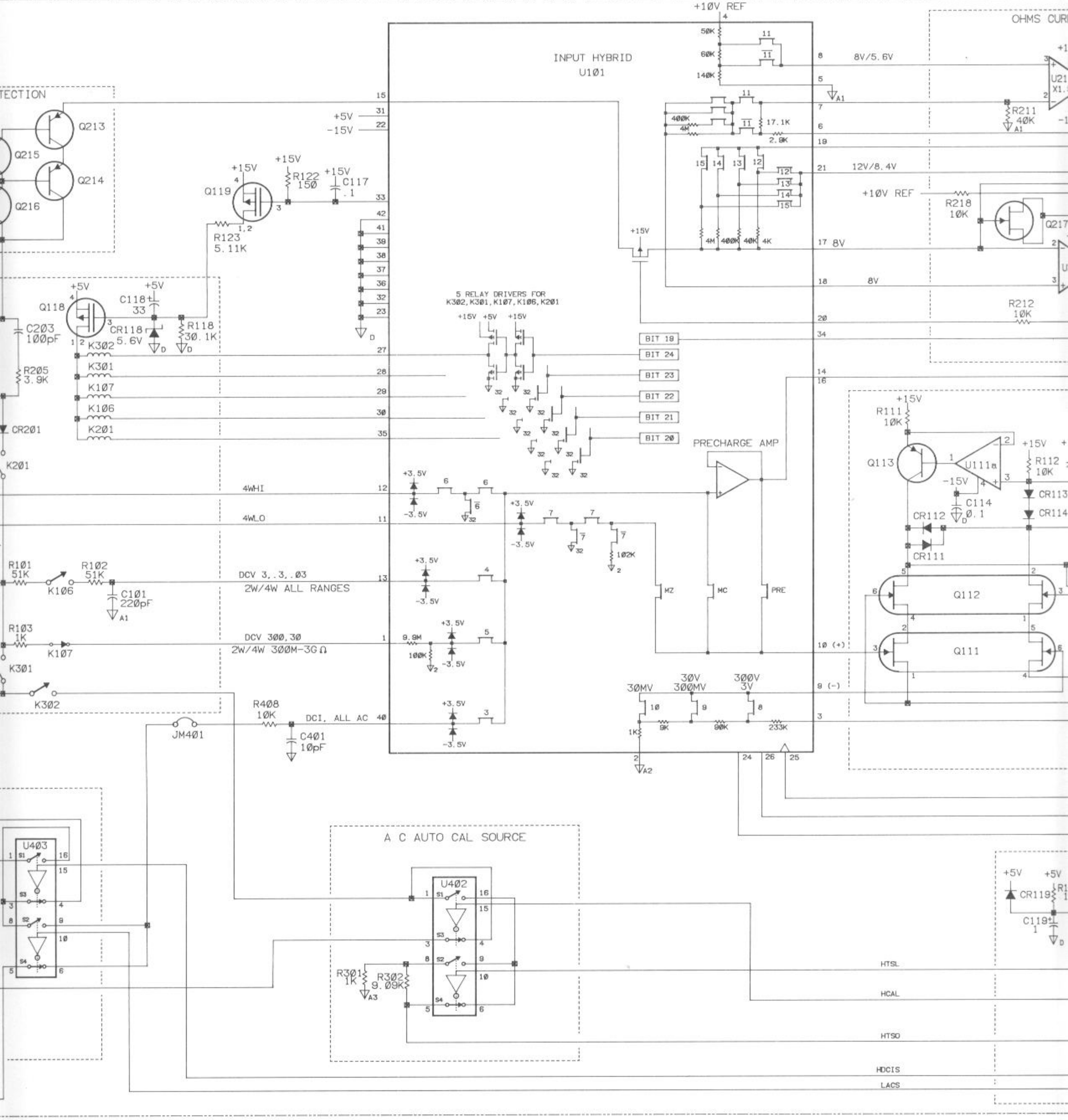

C202
C201
C101
R204
R202
R102
R203
R201
R101
LABEL
E401
E101
R104
RV101
J101
J102
K101
K102
FX101
U216
U214
R212
R216
CR202
R218
C213
C212
C214
Q211
Q212
Q217
C203
R205
R206
L201
CR201
R213
R214
U212
C204
U213
K106
K201
K103
K104
J103
J104
J105
J108
J109
J110
J106
J107
CR126
CR128
R121
C122
U121
Q215
Q216
Q213
Q214
R103
U101
K107
U401
CR404
CR401
CR403
CR402
L401
C402
K401
Q111
Q112
R113
Q114
Q113
K301
C403
TP1
J302
J301
R401
K402
CR129
CR130
CR131
CR132
CR133
CR134
CR121
CR122
CR123
CR124
CR125
CR127
CR135
R211
U211
CR111
CR112
CR114
CR113
C112
R111
R112
U112
R116
R117
R115
R114
U111
C111
C113
C114
K302
U402
U403
R402
R403
R404
R405
CR136
CR137
C123
Q121
K403
C121
C211
R217
R215
C401
R408
JM401
R122
C117
R223
R221
R222
U218
C119
U217
CR119
R119
U122
U123
R301
R302
R123
C118
CR118
R118
JM501
L501
TP9
C502
C503
Q119
JM102
J303
Q118
U517
C525
C524
R551
CR532
TP8
R503
R542
R541
R547
U506
U508
U505
C504
R500
U501
JM902
JM922
JM912
JM911
JM901
JM921
REFBRD
TP7
TP6
U516
U511
C523
R546
JM502
U507
U502
U503
J501
C901
C902
CR903
U901
C922
CR924
CR914
CR913
CR923
C921
C526
R531
R532
C522
R533
Q522
TP2
JM101
TP5
U515
J502
R507
C501
TP3
CR904
CR902
CR901
CR921
CR922
CR911
CR912
R910
C910
J901
U921
R524
R527
R526
C517
U513
TP4
R516
C516
C511
R521
C521
R504
R544
R543
R548
R545
Q511
U504
C505
R505
R502
C506
R506
C912
U911
C911
U514
Q512
R523
CR514
CR513
C515
R513
R515
CR511
CR512
C513
C514
U512
Q514
C531
R514
Q515
R528
R529
R536
R535
R511
R519
R520
R518
C512
Q513
R517
R501
Q501
R508
U509
U510
P501

3457S: CL. 502A

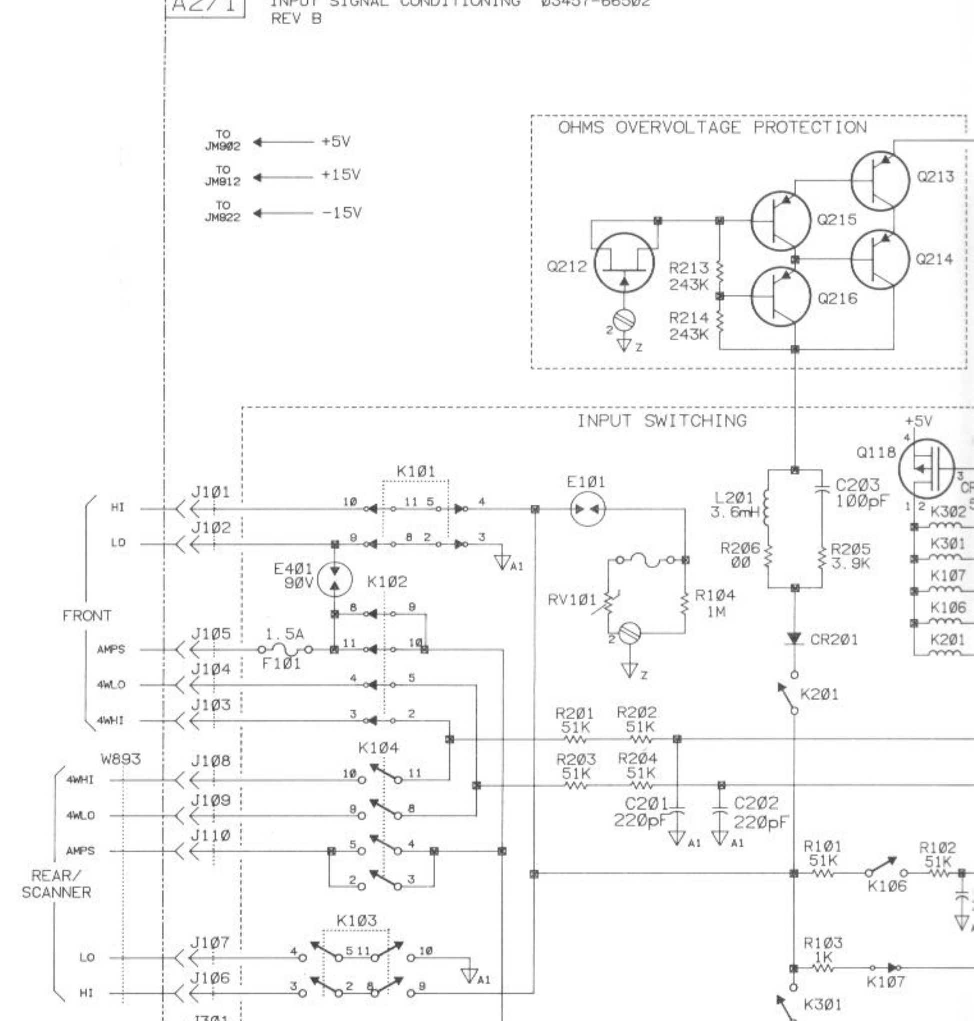

OHMS CURRENT SOURCE
U211
X1.5
12V/8.4V
U212
X1
C212
0.1
C214
200pF
Q211
R211
40K
C204
150pF
Q217
CR202
15V
U213
C213
0.1
R212
10K
U214
R215
10K
R219
10K
+15V
-15V
+5V
Vos
PRECHARGE OFFSET ADJ
U216
SUB
R216
511K
R217
511K
C211
.001
INPUT AMPLIFIER
R112
10K
C112
1000pF
CR113
CR114
C113
0.1
U111b
C111
56pF
Vos ADJ
R113
Q114
U112a
U112b
R116
100K
R117
100K
+10V REF
R115
20K
R114
5.11K
ADC
TO JM101
JM102
±10V
DAC
J303
W303
DAC
TO
03457-66503
SDS
SDO
SDC 6
FROM U501(27)
SDO
FROM U501(21)
SDS
FROM U502-6
SDC 4
FROM U501(25)
TO SCHEM A2/2
OFFSET DAC
CR119
R119
1M
C119
1
U123
U122
DATA
MSB
LSB
U217
OUT
Vref
Ref
U218b
R221
49.9K
R222
100K
R223
100K
U218a
BUFF+10V
FROM U517
LERD
TO Q121
TO SCHEM A2/2
3457S: A2.1REVB

REF DESIG	+15V	-15V	⏚D
U214	11	14	13
U218	8	4	
U402	11	14	13
U403	11	14	13

Figure 8-20. 03457-66502 (A2/1), Input Signal Conditioning, Rev. B

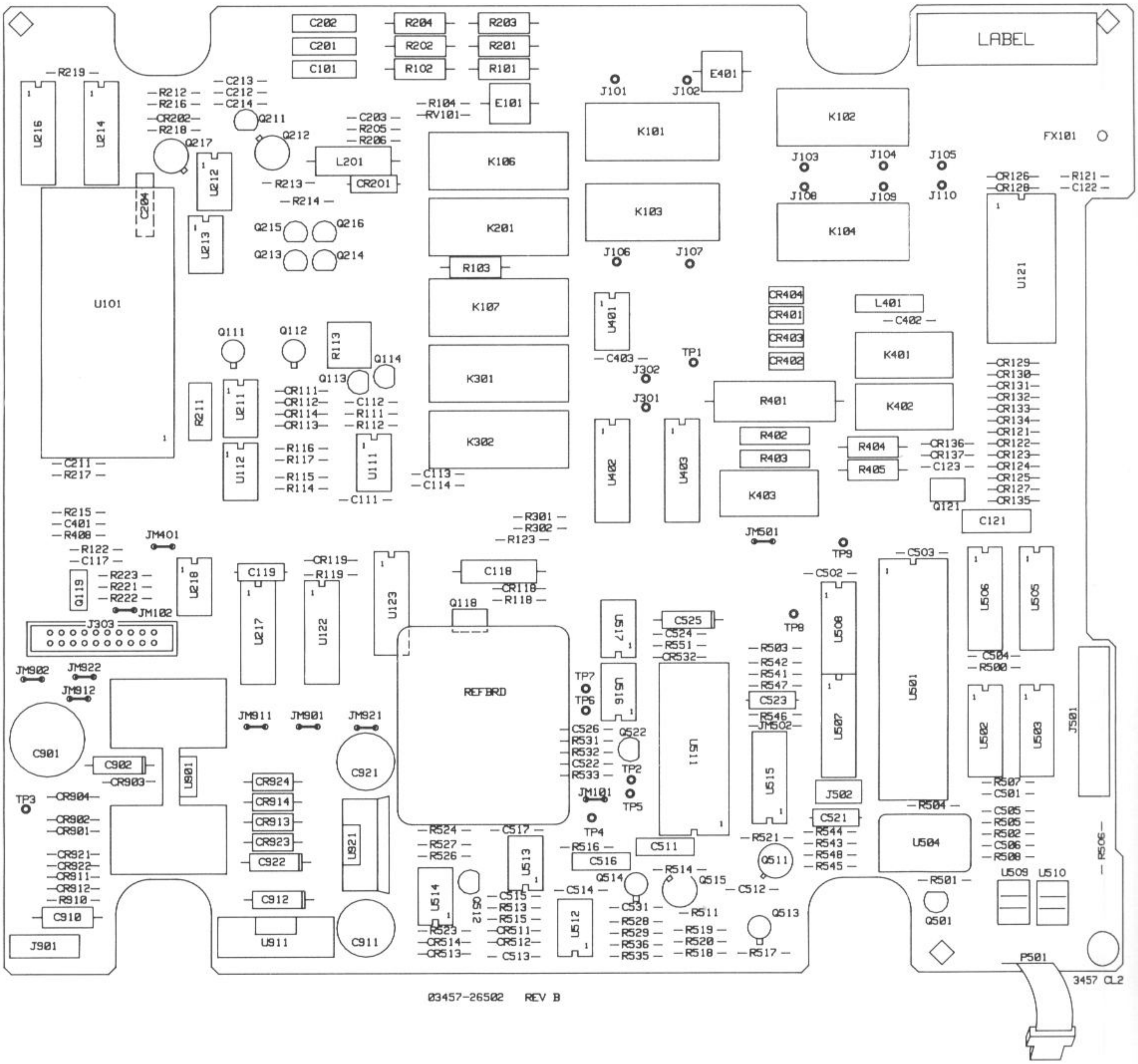


+10V REF
INPUT HYBRID
U101
50K
60K
140K
8V/5.6V
400K
4M
17.1K
2.8K
12V/8.4V
+10V REF
R218
10K
Q217
17 8V
18 8V
4M 400K 40K 4K
R212
10K
OHMS CUR
U21
X1.
R211
40K
TECTION
Q213
Q215
Q214
Q216
+5V
-15V
+15V
Q119
R122
150
C117
.1
R123
5.11K
Q118
C118
33
CR118
5.6V
R118
30.1K
C203
100pF
R205
3.9K
CR201
K201
K302
K301
K107
K106
K201
5 RELAY DRIVERS FOR K302,K301,K107,K106,K201
BIT 19
BIT 24
BIT 23
BIT 22
BIT 21
BIT 20
PRECHARGE AMP
+3.5V
-3.5V
4WHI
4WLO
102K
MZ
MC
PRE
R101
51K
K106
R102
51K
C101
220pF
DCV 3,.3,.03
2W/4W ALL RANGES
R103
1K
K107
DCV 300,30
2W/4W 300M-3G Ω
9.9M
100K
K301
K302
R408
10K
DCI, ALL AC
C401
10pF
JM401
30MV
30V
300MV
300V
3V
9K
90K
233K
1K
10 (+)
9 (-)
Q113
U111a
R111
10K
R112
10K
CR113
CR114
C114
0.1
CR112
CR111
Q112
Q111
CR119
C119
U403
A C AUTO CAL SOURCE
U402
R301
1K
R302
9.09K
HTSL
HCAL
HTSO
HDCIS
LACS



A2/1 INPUT SIGNAL CONDITIONING 03457-66502
REV B

TO JM902 +5V
TO JM912 +15V
TO JM922 -15V
OHMS OVERVOLTAGE PROTECTION
Q213
Q215
Q214
Q212
R213 243K
R214 243K
Q216
INPUT SWITCHING
+5V
Q118
K101
E101
L201 3.6mH
C203 100pF
HI
J101
LO
J102
E401 90V
K102
R206 00
R205 3.9K
K302
K301
K107
K106
K201
RV101
R104 1M
FRONT
J105
1.5A
F101
AMPS
J104
4WLO
J103
4WHI
CR201
K201
R201 51K
R202 51K
W893
K104
J108
R203 51K
R204 51K
J109
C201 220pF
C202 220pF
J110
REAR/ SCANNER
R101 51K
K106
R102 51K
K103
J107
R103 1K
K107
J106
K301
AC HI
J301
K302
AC LO
J302
AMPS
C403 0.1
C402 100p
L401 1uH
+15V
-15V
U401a
K402
K403
R405 900
R404 90
R403 9
R402 1
U403
CR401
CR403
CR402
CR404
K401
TP1
R401 0.1
TO 03457-66503
NOTE: ALL RELAYS SHOWN IN TURN-ON POSITION
W303
VAC
J303


C202
R204
R203
LABEL
C201
R202
R201
C101
R102
R101
R219
C213
C212
C214
R212
R216
CR202
R218
Q211
R104
RV101
E101
J101
J102
E401
K101
K102
U216
U214
Q212
C203
R205
R206
Q217
L201
K106
FX101
J103
J104
J105
U212
R213
CR201
CR126
CR128
R121
C122
R214
J108
J109
J110
C204
K103
K104
U213
Q215
Q216
K201
U121
Q213
Q214
R103
J106
J107
U101
K107
CR404
L401
CR401
C402
U401
Q111
Q112
R113
CR403
K401
Q114
C403
TP1
CR402
CR129
CR130
CR131
CR132
CR133
CR134
CR121
CR122
CR123
CR124
CR125
CR127
CR135
Q113
K301
J302
J301
R401
K402
CR111
CR112
CR114
CR113
C112
R111
R112
R211
U211
K302
U402
U403
R402
R404
CR136
CR137
C123
R403
R405
R116
R117
R115
R114
U112
U111
C113
C114
K403
C211
R217
C111
Q121
C121
R215
C401
R408
R301
R302
R123
JM401
JM501
R122
C117
CR119
TP9
C503
R223
R221
R222
U218
Q119
C119
R119
U123
C118
CR118
R118
C502
U506
U505
Q118
JM102
J303
U217
U122
U517
C525
TP8
U508
U501
C524
R551
CR532
R503
JM902
JM922
R542
C504
R500
JM912
REFBRD
TP7
TP6
U516
R541
R547
C523
U502
U503
J501
JM911
JM901
JM921
R546
JM502
C901
C902
C526
R531
Q522
R532
C522
U511
U515
U507
CR903
U901
C921
R533
TP2
CR924
R507
C501
TP3
CR904
CR914
JM101
TP5
J502
R504
C505
CR902
CR913
TP4
C521
R505
CR901
R524
C517
R544
R502
CR923
R527
R516
C511
R521
R543
U504
C506
R506
U921
R526
U513
C516
R548
R508
CR921
C922
Q511
R545
CR922
R514
CR911
Q514
Q515
R501
U509
U510
CR912
U514
C515
C514
C512
R910
C912
Q512
R513
C531
R511
Q513
Q501
C910
R515
R528
R519
U512
R523
CR511
R529
R520
J901
U911
C911
CR514
CR512
R536
CR513
C513
R535
R518
R517
P501
3457 CL2
03457-26502 REV B

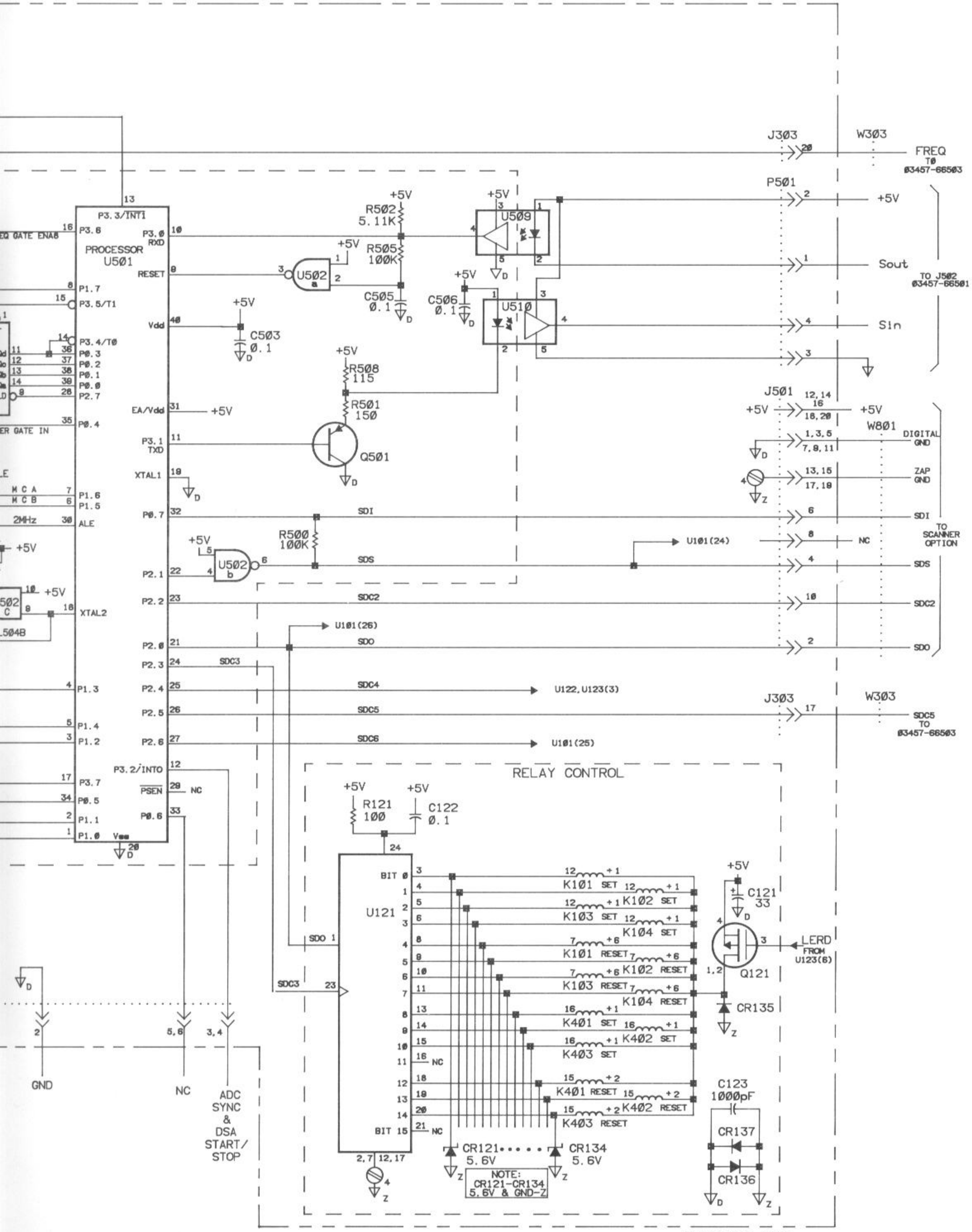
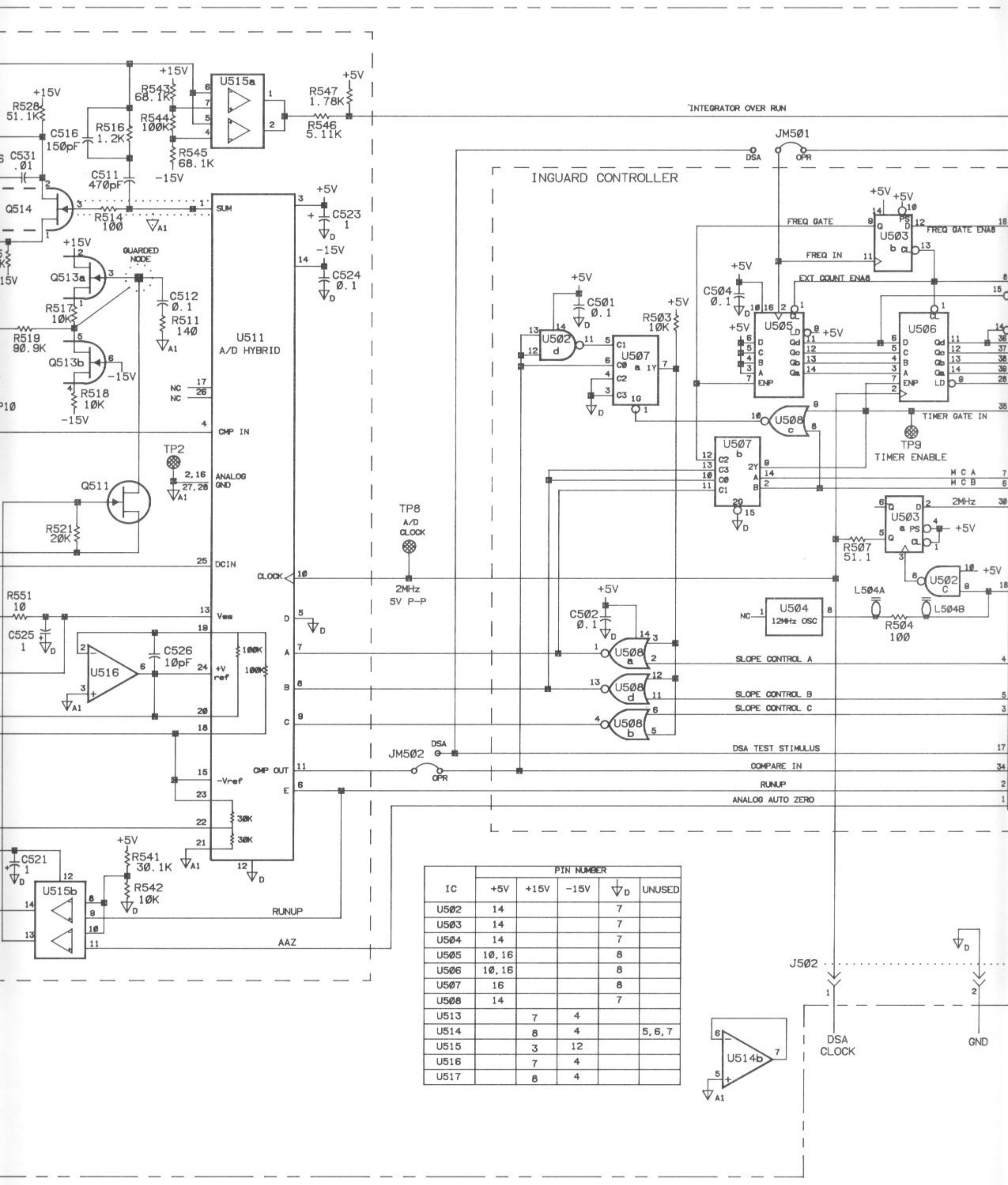

J303
W303
FREQ TO 03457-66503
P501
+5V
Sout
TO J502 03457-66501
Sin
J501
DIGITAL GND
ZAP GND
W801
SDI
NC
TO SCANNER OPTION
SDS
SDC2
SDO
SDC5 TO 03457-66503
PROCESSOR U501
P3.3/INT1
P3.6
P3.0 RXD
RESET
P1.7
P3.5/T1
Vdd
P3.4/T0
P0.3
P0.2
P0.1
P0.0
P2.7
EA/Vdd
P0.4
P3.1 TXD
XTAL1
P1.6
P1.5
P0.7
ALE
P2.1
P2.2
XTAL2
P2.0
P2.3
P1.3
P2.4
P2.5
P1.4
P1.2
P2.6
P3.2/INT0
P3.7
PSEN
P0.5
P1.1
P0.6
P1.0
Vss
FREQ GATE ENAB
TIMER GATE IN
MCA
MCB
2MHz
U502 a
U502 b
U502 C
LS04B
R502 5.11K
R505 100K
C505 0.1
C506 0.1
C503 0.1
U509
U510
R508 115
R501 150
Q501
R500 100K
SDC3
SDC4
SDC6
U101(24)
U101(26)
U122, U123(3)
U101(25)
RELAY CONTROL
R121 100
C122 0.1
U121
BIT 0
BIT 15
K101 SET
K102 SET
K103 SET
K104 SET
K101 RESET
K102 RESET
K103 RESET
K104 RESET
K401 SET
K402 SET
K403 SET
K401 RESET
K402 RESET
K403 RESET
C121 33
Q121
LERD FROM U123(6)
CR135
C123 1000pF
CR137
CR136
CR121
CR134
5.6V
NOTE: CR121-CR134 5.6V & GND-Z
GND
NC
ADC SYNC & DSA START/ STOP
3457S: 2A2. REVB

Figure 8-21. 03457-66502 (A2/2), A/D Converter, Inguard Controller, Rev. B

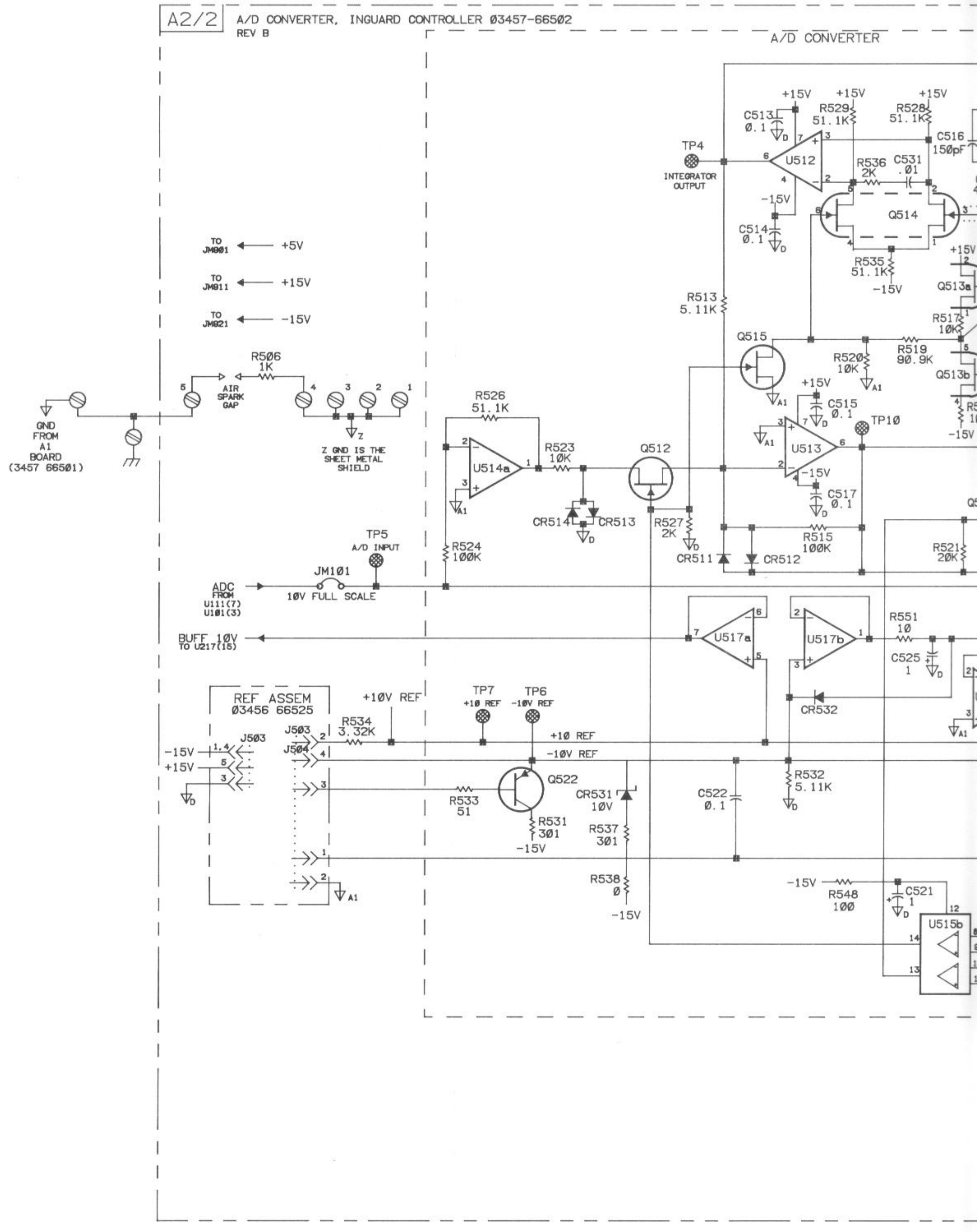


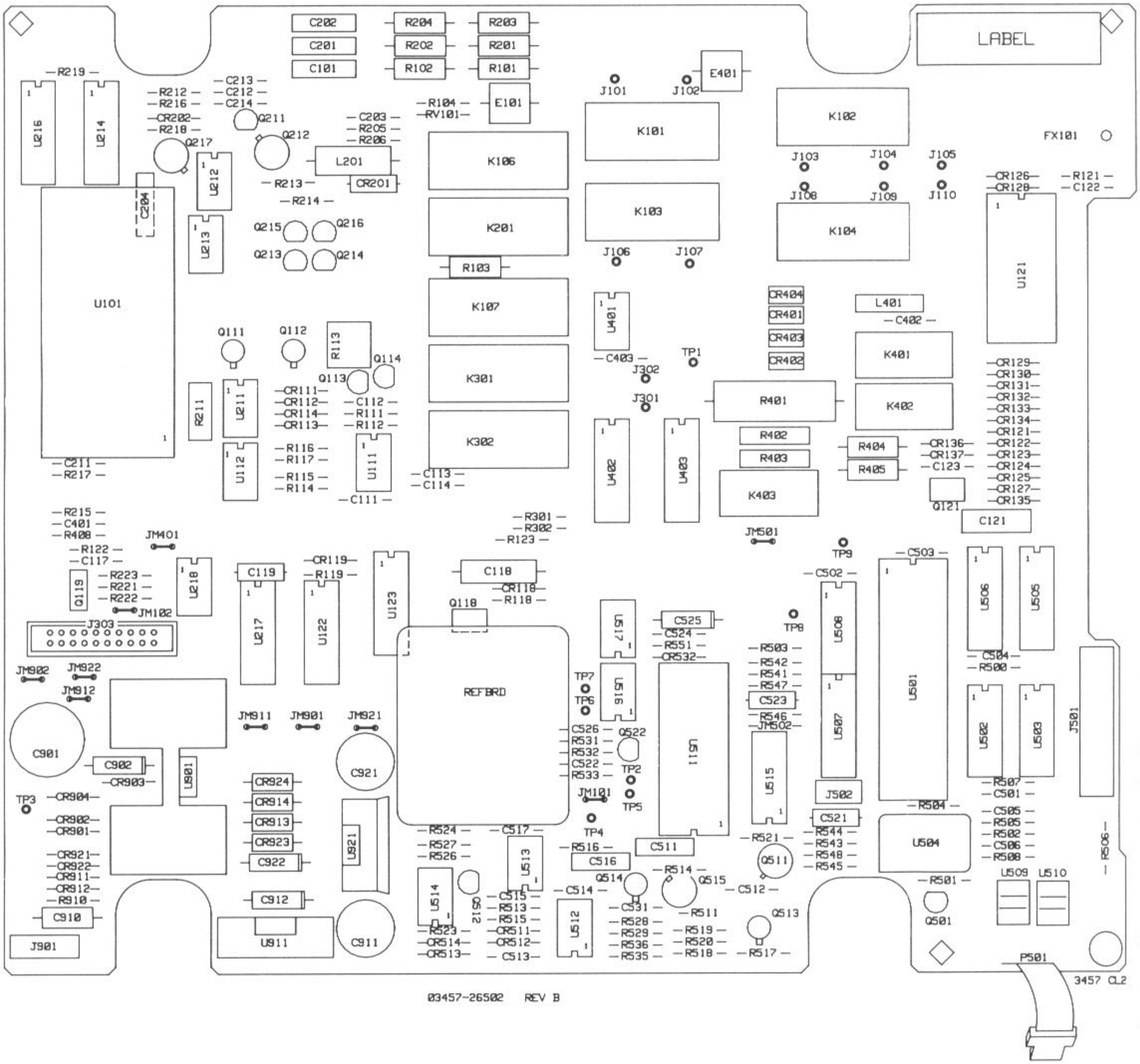
INTEGRATOR OVER RUN
INGUARD CONTROLLER
U511
A/D HYBRID
U515a
U515b
U516
U514b
Q514
Q513a
Q513b
Q511
GUARDED NODE
R528 51.1K
R543 68.1K
R544 100K
R545 68.1K
R516 1.2K
R547 1.78K
R546 5.11K
R514 100
R517 10K
R519 90.9K
R511 140
R518 10K
R521 20K
R551 10
R541 30.1K
R542 10K
R503 10K
R507 51.1
R504 100
C516 150pF
C531 .01
C511 470pF
C523 1
C524 0.1
C512 0.1
C525 1
C526 10pF
C521 1
C501 0.1
C502 0.1
C504 0.1
+15V
-15V
+5V
SUM
CMP IN
ANALOG GND
DCIN
CLOCK
Vss
+V ref
-Vref
CMP OUT
NC
TP2
TP8
A/D CLOCK
2MHz
5V P-P
TP9
TIMER ENABLE
JM501
JM502
DSA
OPR
U502 d
U502 c
U503 a
U503 b
U504
12MHz OSC
U505
U506
U507 a
U507 b
U508 a
U508 b
U508 c
U508 d
L504A
L504B
FREQ GATE
FREQ IN
FREQ GATE ENAB
EXT COUNT ENAB
TIMER GATE IN
M C A
M C B
2MHz
SLOPE CONTROL A
SLOPE CONTROL B
SLOPE CONTROL C
DSA TEST STIMULUS
COMPARE IN
RUNUP
ANALOG AUTO ZERO
AAZ
J502
DSA CLOCK
GND

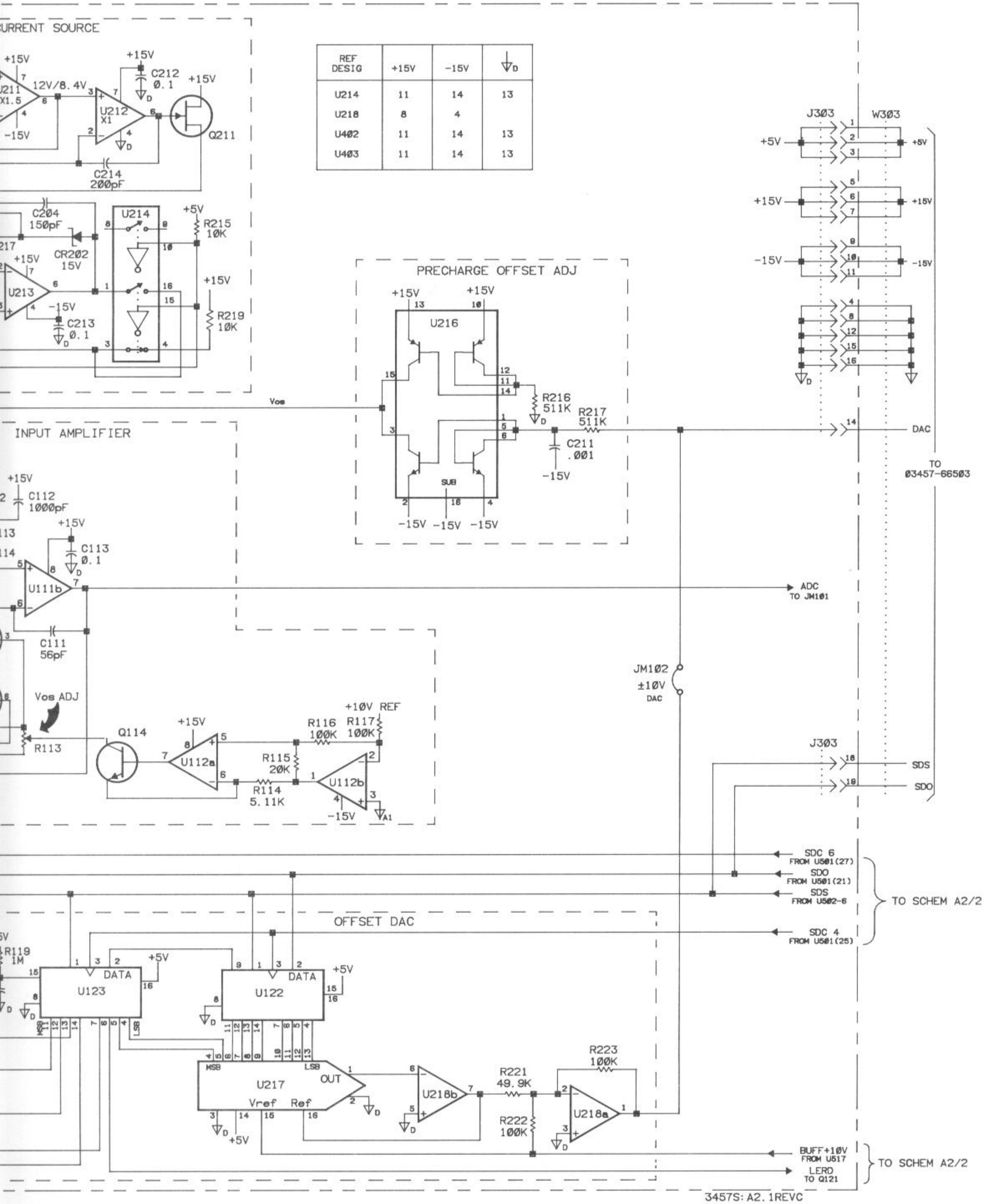
IC	PIN NUMBER +5V	+15V	-15V	⏚D	UNUSED
U502	14			7	
U503	14			7	
U504	14			7	
U505	10, 16			8	
U506	10, 16			8	
U507	16			8	
U508	14			7	
U513		7	4		
U514		8	4		5, 6, 7
U515		3	12		
U516		7	4		
U517		8	4		

A2/2 A/D CONVERTER, INGUARD CONTROLLER 03457-66502

REV B

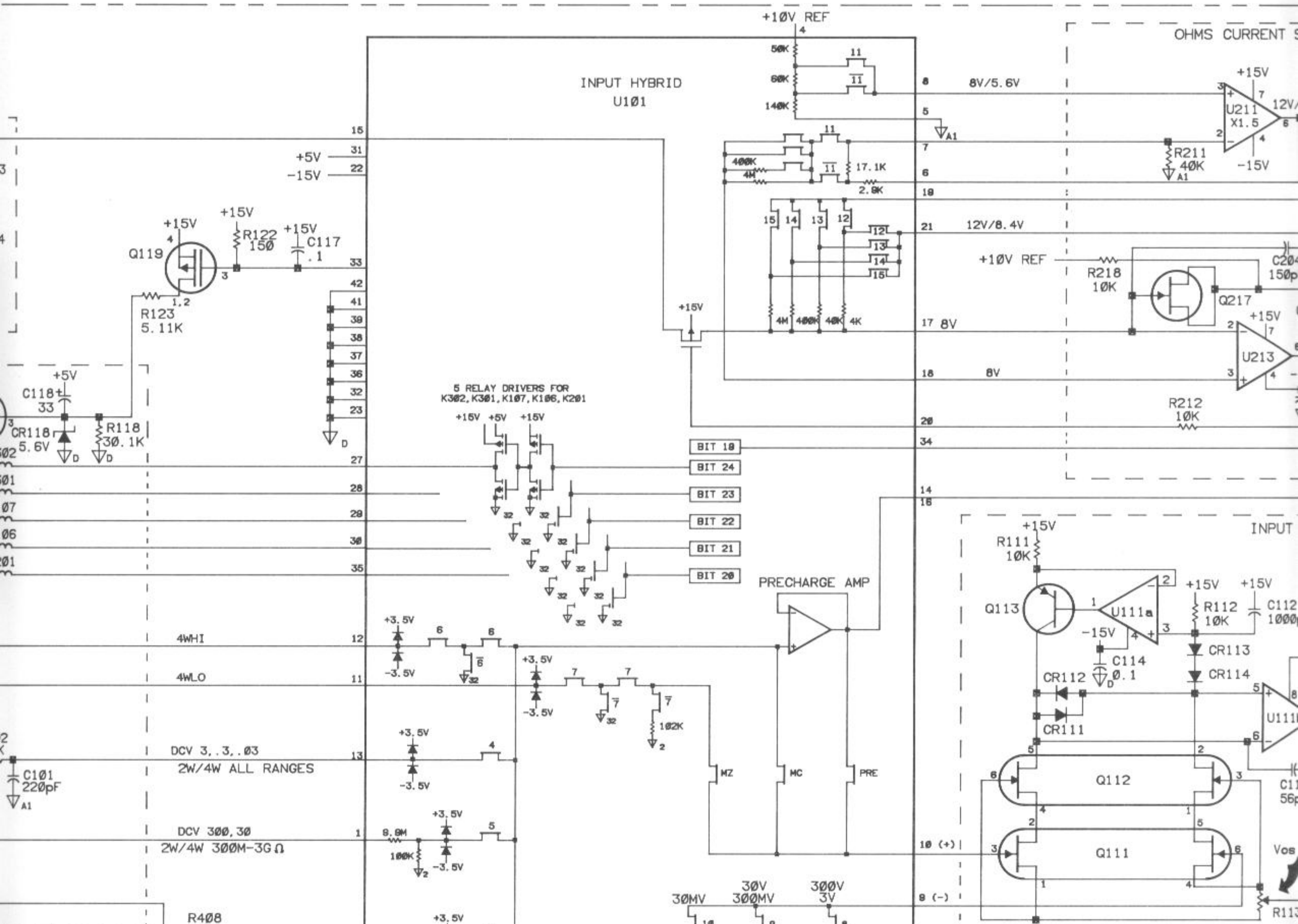

A/D CONVERTER
+15V
C513
0.1
R529
51.1K
R528
51.1K
C516
150pF
TP4
INTEGRATOR OUTPUT
U512
R536
2K
C531
.01
-15V
C514
0.1
Q514
R535
51.1K
Q513a
R513
5.11K
R517
10K
Q515
R520
10K
R519
90.9K
Q513b
TO JM001
+5V
TO JM011
+15V
TO JM021
-15V
R506
1K
AIR SPARK GAP
GND FROM A1 BOARD (3457 66501)
Z GND IS THE SHEET METAL SHIELD
R526
51.1K
U514a
R523
10K
Q512
C515
0.1
TP10
U513
C517
0.1
CR514
CR513
R527
2K
R515
100K
CR511
CR512
R521
20K
TP5
A/D INPUT
R524
100K
JM101
ADC FROM U111(7) U101(3)
10V FULL SCALE
BUFF 10V TO U217(15)
U517a
U517b
R551
10
C525
1
CR532
REF ASSEM 03456 66525
J503
J503
J504
+10V REF
R534
3.32K
TP7
+10 REF
TP6
-10V REF
+10 REF
-10V REF
Q522
R533
51
R531
301
CR531
10V
R537
301
R538
0
C522
0.1
R532
5.11K
-15V
R548
100
C521
1
U515b


C202
C201
C101
R204
R202
R102
R203
R201
R101
LABEL
E401
E101
R219
U216
U214
R212
R216
CR202
R218
C213
C212
C214
Q211
Q212
Q217
R104
RV101
C203
R205
R206
L201
CR201
R213
R214
U212
C204
U213
Q215
Q216
Q213
Q214
J101
J102
K101
K102
K106
K103
K201
K104
FX101
J103
J104
J105
J108
J109
J110
CR126
CR128
R121
C122
R103
J106
J107
U101
U121
K107
U401
L401
C402
CR404
CR401
CR403
CR402
K401
Q111
Q112
R113
Q114
Q113
TP1
C403
J302
J301
K301
K302
R211
U211
CR111
CR112
CR114
CR113
C112
R111
R112
R401
K402
CR129
CR130
CR131
CR132
CR133
CR134
CR121
CR122
CR123
CR124
CR125
CR127
CR135
R402
R403
R404
R405
CR136
CR137
C123
U112
R116
R117
R115
R114
U111
C113
C114
C111
U402
U403
K403
Q121
C121
C211
R217
R215
C401
R408
R122
C117
JM401
R301
R302
R123
JM501
TP9
Q119
R223
R221
R222
JM102
U218
C119
CR119
R119
U123
C118
CR118
R118
Q118
C503
C502
U506
U505
J303
U217
U122
U517
C525
C524
R551
CR532
TP8
U508
R503
R542
R541
R547
C523
CR546
JM502
U501
C504
R500
JM902
JM922
JM912
TP7
TP6
REFBRD
U516
JM911
JM901
JM921
C526
R531
R532
C522
R533
Q522
TP2
TP5
U511
U515
U507
U502
U503
J501
C901
C902
CR903
U901
CR924
CR914
CR913
CR923
C922
C921
TP3
CR904
CR902
CR901
CR921
CR922
CR911
CR912
R910
C910
J901
U921
C912
U911
C911
JM101
TP4
J502
C521
R507
C501
R504
C505
R505
R502
C506
R508
R506
R524
R527
R526
C517
U513
R516
C516
C511
R521
R544
R543
R548
R545
U504
Q511
R514
Q514
Q515
C512
R501
U509
U510
U514
Q512
C515
R513
R515
CR511
CR512
C513
R523
CR514
CR513
C514
U512
C531
R528
R529
R536
R535
R511
R519
R520
R518
Q513
R517
Q501
P501
03457-26502 REV B
3457 CL2

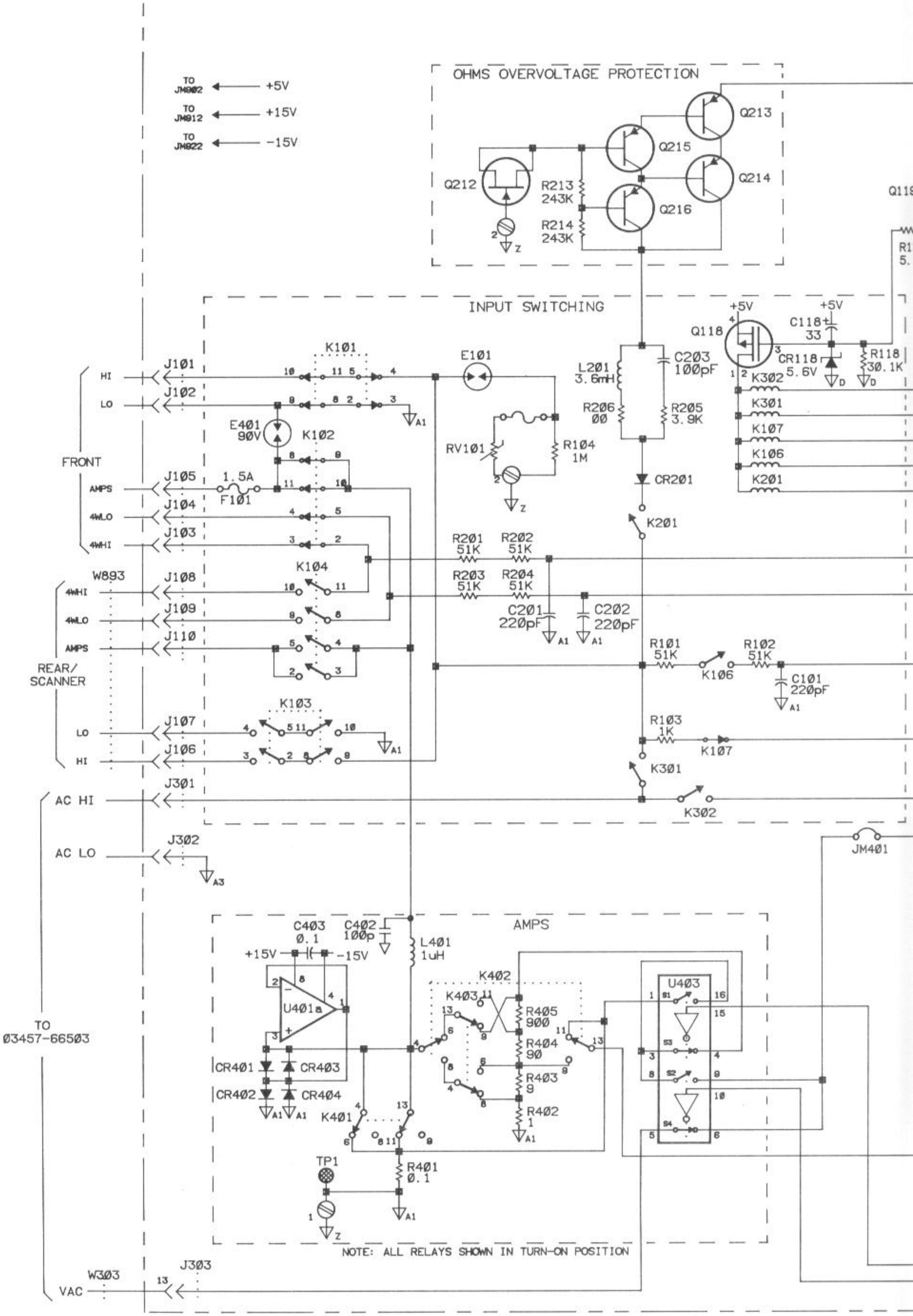

CURRENT SOURCE
U211 X1.5
12V/8.4V
U212 X1
C212 0.1
Q211
C214 200pF
C204 150pF
CR202 15V
U214
R215 10K
U213
C213 0.1
R219 10K
Vos
PRECHARGE OFFSET ADJ
U216
SUB
R216 511K
R217 511K
C211 .001
INPUT AMPLIFIER
C112 1000pF
C113 0.1
U111b
C111 56pF
Vos ADJ
R113
Q114
U112a
U112b
R114 5.11K
R115 20K
R116 100K
R117 100K
+10V REF
ADC TO JM101
JM102 ±10V DAC
J303
W303
DAC
TO 03457-66503
SDS
SDO
SDC 6 FROM U501(27)
SDO FROM U501(21)
SDS FROM U502-6
SDC 4 FROM U501(25)
TO SCHEM A2/2
OFFSET DAC
R119 1M
U123
U122
DATA
MSB
LSB
U217
OUT
Vref
Ref
U218b
U218a
R221 49.9K
R222 100K
R223 100K
BUFF+10V FROM U517
LERD TO Q121
TO SCHEM A2/2
3457S: A2.1REVC

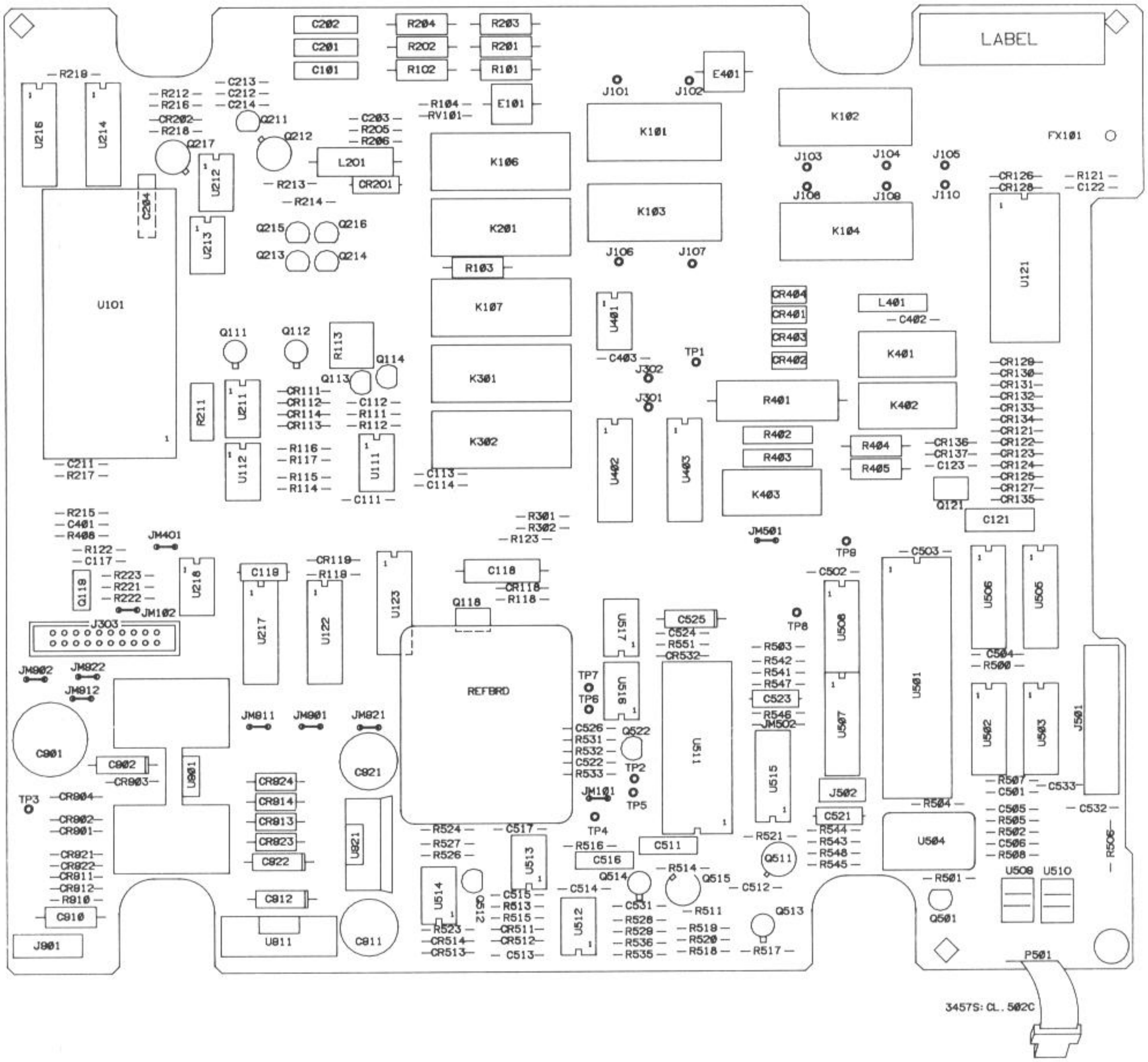
REF DESIG	+15V	-15V	⏚D
U214	11	14	13
U218	8	4	
U402	11	14	13
U403	11	14	13

Figure 8-22. 03457-66502 (A2/1), Input Signal Conditioning, Rev. C


INPUT HYBRID
U101
+10V REF
OHMS CURRENT S
8V/5.6V
12V/8.4V
+10V REF
R218
10K
Q217
C204
150p
U211
X1.5
R211
40K
U213
R212
10K
8V
Q119
R122
150
C117
.1
R123
5.11K
+15V
+5V
-15V
C118
33
CR118
5.6V
R118
30.1K
5 RELAY DRIVERS FOR K302, K301, K107, K106, K201
BIT 18
BIT 24
BIT 23
BIT 22
BIT 21
BIT 20
PRECHARGE AMP
MZ
MC
PRE
4WHI
4WLO
DCV 3, .3, .03
2W/4W ALL RANGES
C101
220pF
DCV 300, 30
2W/4W 300M-3G Ω
R408
10K
DCI, ALL AC
C401
10pF
JM401
30MV
30V
300MV
300V
3V
1K
9K
90K
233K
9.9M
100K
102K
50K
60K
140K
400K
4M
17.1K
2.9K
400K
40K
4K
10 (+)
9 (-)
INPUT
R111
10K
Q113
U111a
-15V
C114
0.1
R112
10K
C112
1000p
CR113
CR114
CR112
CR111
U111
Q112
Q111
Vos
R113
C11
56p
A C AUTO CAL SOURCE
U402
R301
1K
R302
9.09K
HTSL
HCAL
HTSO
HDCIS
LACS
CR119
R119
1M
C119
1

A2/1 INPUT SIGNAL CONDITIONING 03457-66502
REV C


TO JM902 +5V
TO JM912 +15V
TO JM922 -15V
OHMS OVERVOLTAGE PROTECTION
Q212
Q213
Q214
Q215
Q216
R213 243K
R214 243K
Q119
INPUT SWITCHING
+5V
+5V
Q118
C118 33
CR118 5.6V
R118 30.1K
K302
K301
K107
K106
K201
K101
E101
L201 3.6mH
C203 100pF
R206 00
R205 3.9K
RV101
R104 1M
CR201
K201
E401 90V
K102
J101 HI
J102 LO
FRONT
J105 AMPS
1.5A F101
J104 4WLO
J103 4WHI
W893
J108 4WHI
J109 4WLO
J110 AMPS
REAR/ SCANNER
K104
R201 51K
R202 51K
R203 51K
R204 51K
C201 220pF
C202 220pF
R101 51K
K106
R102 51K
C101 220pF
K103
J107 LO
J106 HI
R103 1K
K107
K301
J301 AC HI
K302
J302 AC LO
JM401
TO 03457-66503
AMPS
C403 0.1
C402 100p
+15V
-15V
L401 1uH
U401a
K402
K403
R405 900
R404 90
R403 9
R402 1
U403
CR401
CR402
CR403
CR404
K401
TP1
R401 0.1
NOTE: ALL RELAYS SHOWN IN TURN-ON POSITION
W303 VAC
J303


C202
R204
R203
C201
R202
R201
C101
R102
R101
LABEL
R219
C213
C212
C214
R212
R216
CR202
R218
Q211
Q212
Q217
U216
U214
U212
C204
U213
R104
RV101
E101
C203
R205
R206
L201
R213
CR201
R214
K106
Q215
Q216
Q213
Q214
K201
R103
J101
J102
E401
K101
K102
FX101
J103
J104
J105
J108
J109
J110
K103
K104
CR126
CR128
R121
C122
J106
J107
U121
U101
Q111
Q112
R113
Q114
Q113
K107
CR404
CR401
CR403
CR402
L401
C402
U401
C403
TP1
J302
J301
K401
K402
R401
R211
U211
CR111
CR112
CR114
CR113
C112
R111
R112
K301
R116
R117
R115
R114
U111
U112
K302
C113
C114
C111
C211
R217
U402
U403
R402
R403
R404
R405
CR136
CR137
C123
K403
Q121
C121
CR129
CR130
CR131
CR132
CR133
CR134
CR121
CR122
CR123
CR124
CR125
CR127
CR135
R215
C401
R408
JM401
R122
C117
R301
R302
R123
JM501
TP9
C503
C502
R223
R221
R222
Q119
U218
C119
CR119
R119
U123
C118
CR118
R118
Q118
JM102
J303
U217
U122
U517
C525
C524
R551
CR532
TP8
R503
R542
R541
R547
C523
R546
JM502
U508
U507
U501
U506
U505
C504
R500
U502
U503
J501
JM902
JM922
JM912
C901
C902
CR903
U801
JM811
JM901
JM821
C821
REFBRD
TP7
TP6
U516
C526
R531
R532
C522
R533
Q522
TP2
TP5
JM101
U511
U515
J502
R507
C501
C533
TP3
CR904
CR902
CR901
CR824
CR814
CR813
CR823
U821
R524
R527
R526
C517
TP4
R516
C511
R521
C521
R544
R543
R548
R545
R504
U504
C505
R505
R502
C506
R508
C532
R506
CR821
CR822
CR811
CR812
R810
C822
C812
U513
C516
Q514
R514
Q515
Q511
C512
R501
U509
U510
C810
J801
U811
C811
U514
Q512
C515
R513
R515
R523
CR511
CR514
CR512
CR513
C513
C514
U512
C531
R528
R529
R536
R535
R511
R519
R520
R518
Q513
R517
Q501
P501
3457S: CL. 502C

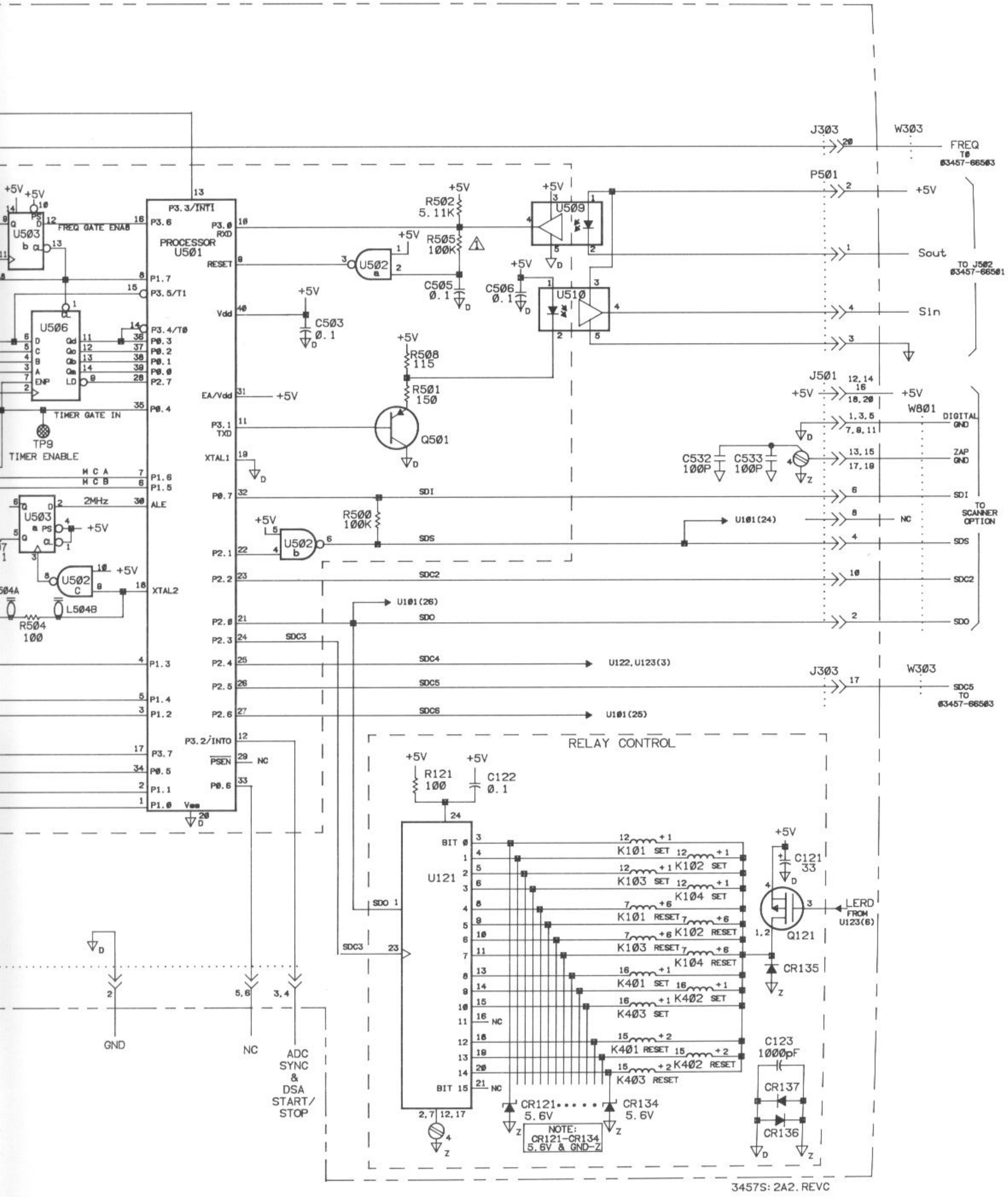
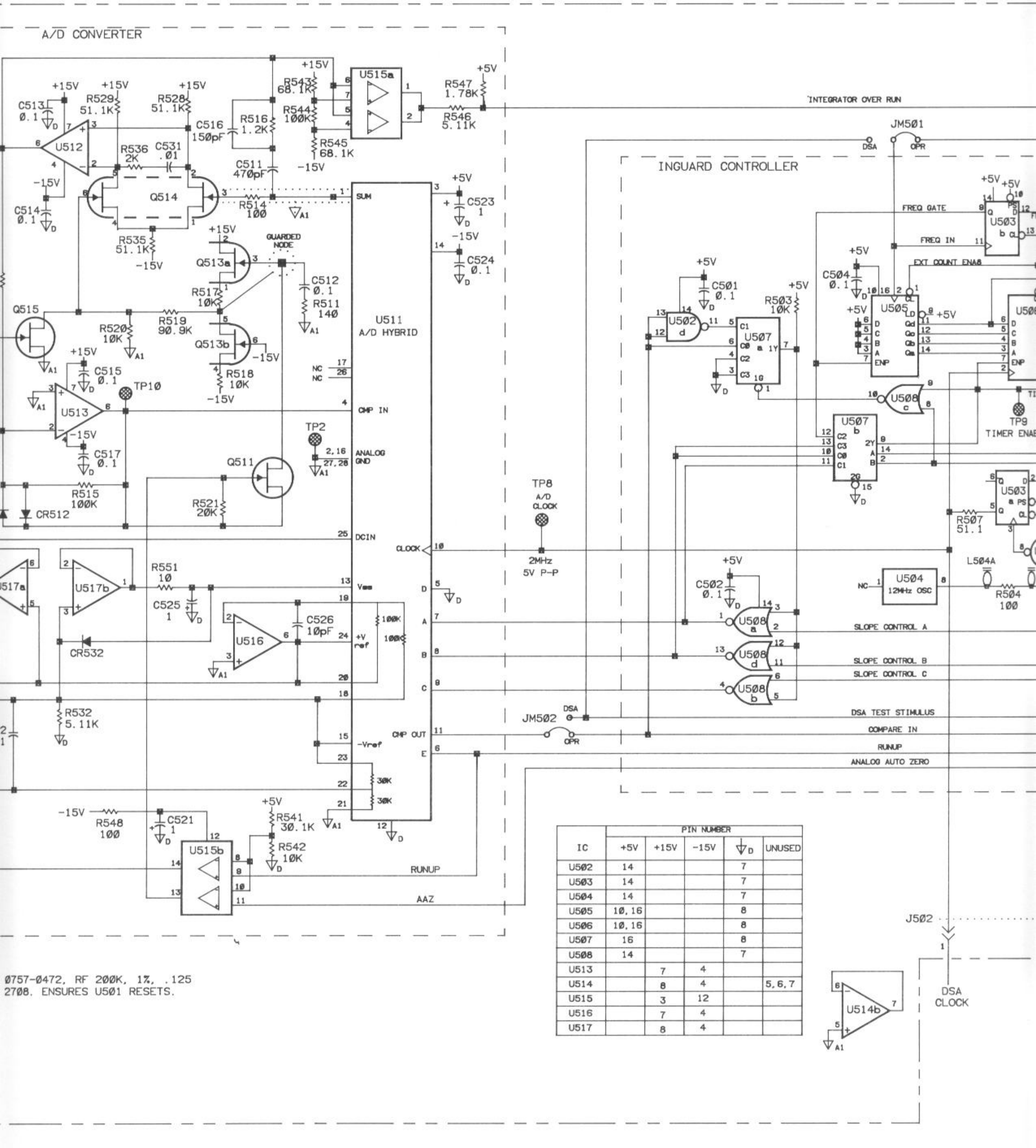

PROCESSOR
U501
P3.3/INT1
P3.6
P3.0 RXD
RESET
P1.7
P3.5/T1
Vdd
P3.4/T0
P0.3
P0.2
P0.1
P0.0
P2.7
EA/Vdd
P0.4
P3.1 TXD
XTAL1
P1.6
P1.5
ALE
P0.7
P2.1
XTAL2
P2.2
P2.0
P2.3
P1.3
P2.4
P2.5
P1.4
P1.2
P2.6
P3.2/INT0
P3.7
PSEN
P0.5
P0.6
P1.1
P1.0
Vss
U503
U506
FREQ GATE ENAB
TIMER GATE IN
TP9
TIMER ENABLE
M C A
M C B
2MHz
U502
L504B
R504
100
+5V
R502
5.11K
R505
100K
C505
0.1
C506
0.1
C503
0.1
U509
U510
R508
115
R501
150
Q501
R500
100K
SDI
SDS
SDC2
SDO
SDC3
SDC4
SDC5
SDC6
U101(24)
U101(26)
U122, U123(3)
U101(25)
NC
J303
W303
P501
J501
W801
FREQ
TO
03457-66503
Sout
Sin
TO J502
03457-66501
DIGITAL GND
ZAP GND
C532
100P
C533
100P
TO SCANNER OPTION
SDC5
TO
03457-66503
RELAY CONTROL
R121
100
C122
0.1
U121
BIT 0
BIT 15
K101 SET
K102 SET
K103 SET
K104 SET
K101 RESET
K102 RESET
K103 RESET
K104 RESET
K401 SET
K402 SET
K403 SET
K401 RESET
K402 RESET
K403 RESET
C121
33
Q121
LERD
FROM
U123(6)
CR135
C123
1000pF
CR137
CR136
CR121
5.6V
CR134
5.6V
NOTE:
CR121-CR134
5.6V & GND-Z
GND
NC
ADC
SYNC
&
DSA
START/
STOP
3457S: 2A2. REVC

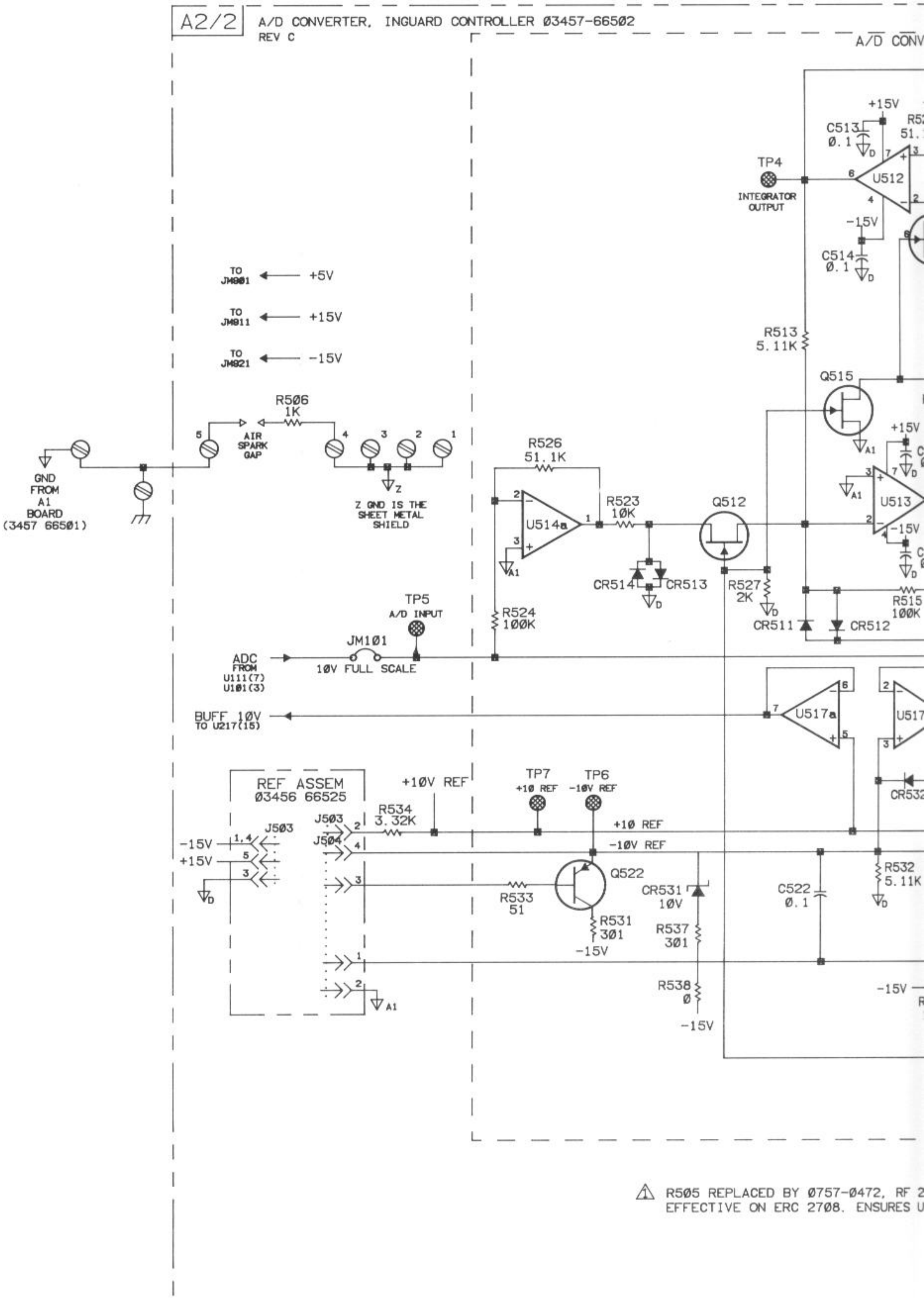
Figure 8-23. 03457-66502 (A2/2), A/D Converter, Inguard Controller, Rev. C


A/D CONVERTER
INGUARD CONTROLLER
U511
A/D HYBRID
SUM
CMP IN
ANALOG GND
DCIN
CLOCK
Vss
+V ref
-Vref
CMP OUT
U512
U513
U515a
U515b
U516
U517a
U517b
Q511
Q513a
Q513b
Q514
Q515
GUARDED NODE
R516 1.2K
R528 51.1K
R529 51.1K
R535 51.1K
R536 2K
R514 100
R517 10K
R518 10K
R519 90.9K
R520 10K
R521 20K
R511 140
R515 100K
R532 5.11K
R541 30.1K
R542 10K
R543 68.1K
R544 100K
R545 68.1K
R546 5.11K
R547 1.78K
R548 100
R551 10
C511 470pF
C512 0.1
C513 0.1
C514 0.1
C515 0.1
C516 150pF
C517 0.1
C521 1
C523 1
C524 0.1
C525 1
C526 10pF
C531 .01
CR512
CR532
TP10
TP2
TP8
A/D CLOCK
2MHz
5V P-P
INTEGRATOR OVER RUN
JM501
JM502
DSA
OPR
FREQ GATE
FREQ IN
EXT COUNT ENAB
U502 d
U503 b
U503 a
U504 12MHz OSC
U505
U506
U507 a
U507 b
U508 a
U508 b
U508 c
U508 d
C501 0.1
C502 0.1
C504 0.1
R503 10K
R504 100
R507 51.1
L504A
TP9
TIMER ENAB
SLOPE CONTROL A
SLOPE CONTROL B
SLOPE CONTROL C
DSA TEST STIMULUS
COMPARE IN
RUNUP
ANALOG AUTO ZERO
AAZ
J502
U514b
DSA CLOCK
+5V
+15V
-15V

IC	PIN NUMBER +5V	+15V	-15V	⏚ D	UNUSED
U502	14			7	
U503	14			7	
U504	14			7	
U505	10, 16			8	
U506	10, 16			8	
U507	16			8	
U508	14			7	
U513		7	4		
U514		8	4		5, 6, 7
U515		3	12		
U516		7	4		
U517		8	4		

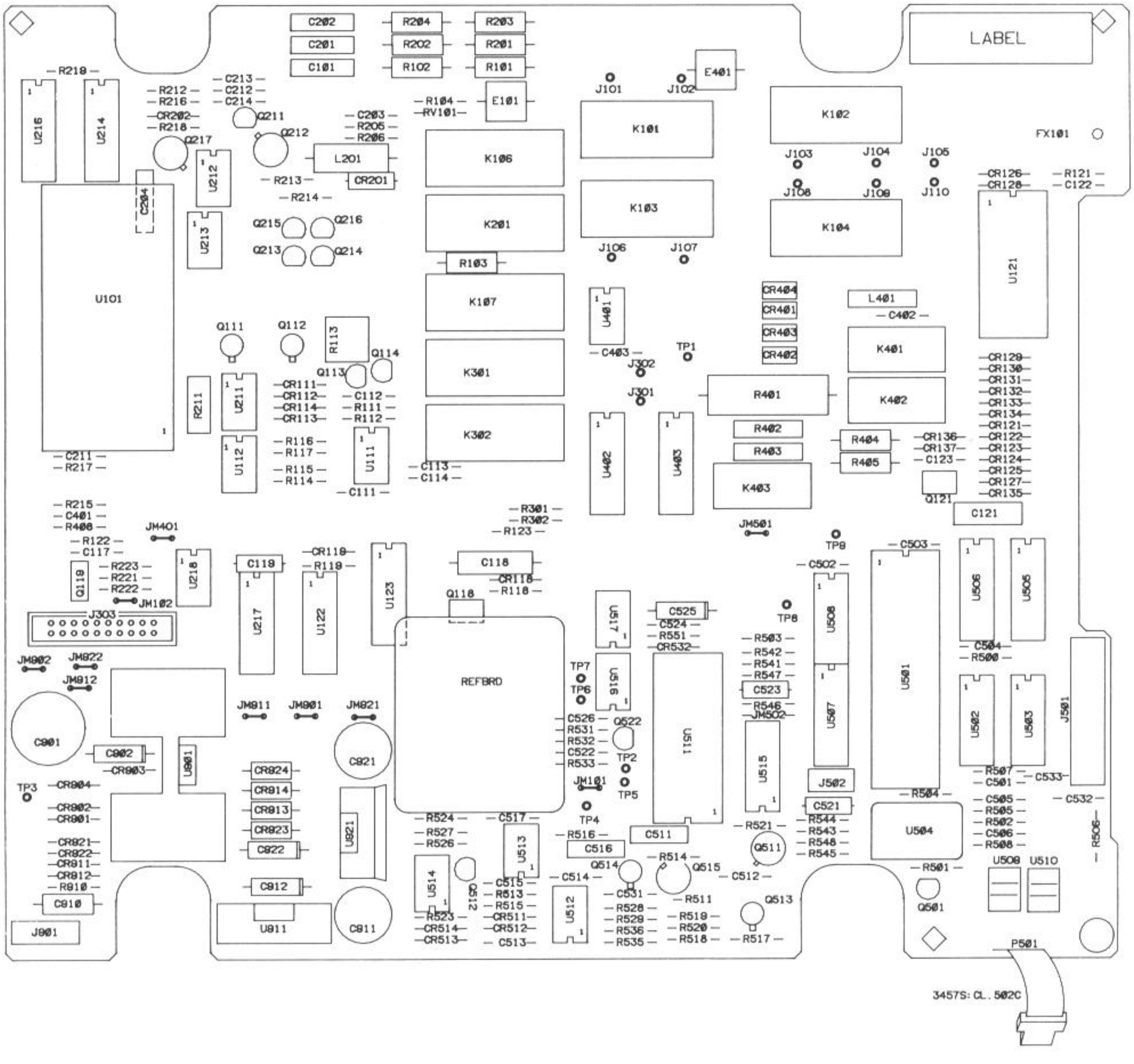
0757-0472, RF 200K, 1%, .125
2708. ENSURES U501 RESETS.

A2/2 A/D CONVERTER, INGUARD CONTROLLER 03457-66502
REV C

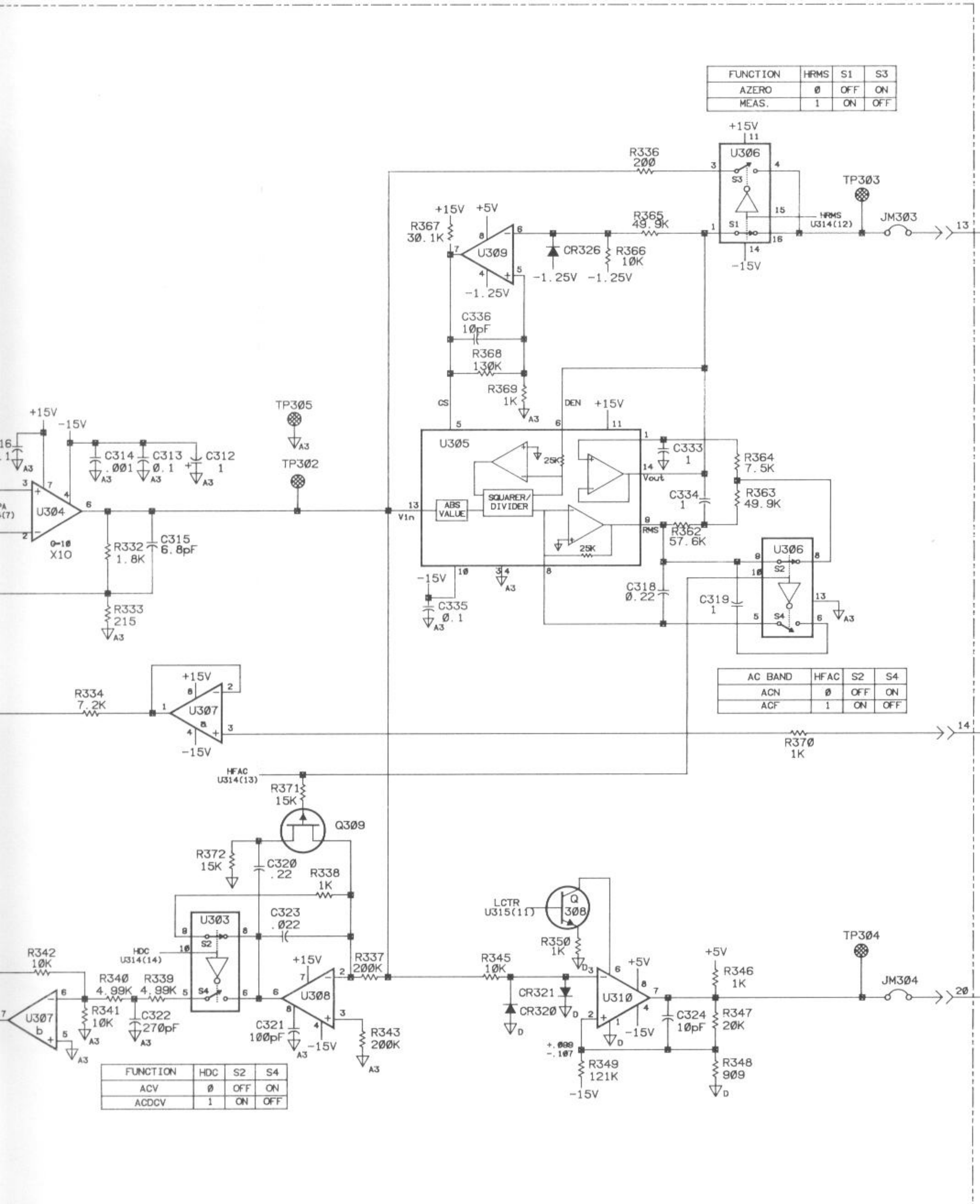


A/D CONV
+15V
C513
0.1
R52
51.
TP4
INTEGRATOR OUTPUT
U512
-15V
C514
0.1
TO JM901
+5V
TO JM911
+15V
TO JM921
-15V
R513
5.11K
Q515
+15V
R506
1K
AIR SPARK GAP
Z GND IS THE SHEET METAL SHIELD
GND FROM A1 BOARD (3457 66501)
R526
51.1K
R523
10K
U514a
Q512
U513
-15V
CR514
CR513
R527
2K
R515
100K
CR511
CR512
TP5
A/D INPUT
R524
100K
JM101
ADC FROM U111(7) U101(3)
10V FULL SCALE
BUFF 10V TO U217(15)
U517a
U517
REF ASSEM
03456 66525
J503
J504
+10V REF
TP7
+10 REF
TP6
-10V REF
R534
3.32K
+10 REF
-10V REF
-15V
+15V
Q522
R533
51
R531
301
CR531
10V
R537
301
R538
0
C522
0.1
R532
5.11K
CR532
-15V

R505 REPLACED BY 0757-0472, RF 2
EFFECTIVE ON ERC 2708. ENSURES U


LABEL
C202
C201
C101
R204
R202
R102
R203
R201
R101
E401
J101
J102
R219
R212
R216
CR202
R218
C213
C212
C214
Q211
Q212
Q217
C203
R205
R206
R104
RV101
E101
K101
K102
FX101
U216
U214
U212
L201
CR201
R213
R214
K106
J103
J104
J105
J108
J109
J110
CR126
CR128
R121
C122
C204
U213
Q215
Q216
Q213
Q214
K201
K103
K104
R103
J106
J107
U121
U101
Q111
Q112
R113
Q113
Q114
K107
U401
C403
TP1
CR404
CR401
CR403
CR402
L401
C402
K401
J302
J301
R401
K402
K301
R211
U211
CR111
CR112
CR114
CR113
C112
R111
R112
CR129
CR130
CR131
CR132
CR133
CR134
CR121
CR122
CR123
CR124
CR125
CR127
CR135
R116
R117
R115
R114
U111
U112
K302
C113
C114
C111
U402
U403
R402
R403
R404
R405
CR136
CR137
C123
K403
Q121
C211
R217
R215
C401
R406
R301
R302
R123
C121
JM401
R122
C117
JM501
TP9
C503
R223
R221
R222
Q119
U218
C119
CR119
R119
U217
U122
U123
C118
CR118
R118
C502
Q118
U517
C525
C524
R551
CR532
TP8
R503
R542
R541
R547
U508
U506
U505
JM102
J303
JM902
JM922
JM912
C504
R500
REFBRD
TP7
TP6
U516
C523
R546
JM502
U507
U501
U502
U503
J501
JM911
JM901
JM921
C526
R531
R532
C522
R533
Q522
TP2
U511
U515
C901
C902
CR903
U901
CR924
C921
CR914
CR913
CR923
TP3
CR904
CR902
CR901
CR921
CR922
CR911
CR912
R910
C910
J901
C922
U921
C912
U911
C911
JM101
TP5
TP4
J502
C521
R507
C501
C533
R504
C505
R505
R502
C506
R508
R506
C532
R524
R527
R526
C517
U513
R516
C516
C511
R521
R544
R543
R548
R545
Q511
U504
U514
Q512
C515
R513
R515
CR511
CR512
C513
R523
CR514
CR513
C514
U512
Q514
R514
Q515
C531
R528
R529
R536
R535
R511
R519
R520
R518
C512
Q513
R517
R501
Q501
U509
U510
P501

3457S: CL. 502C

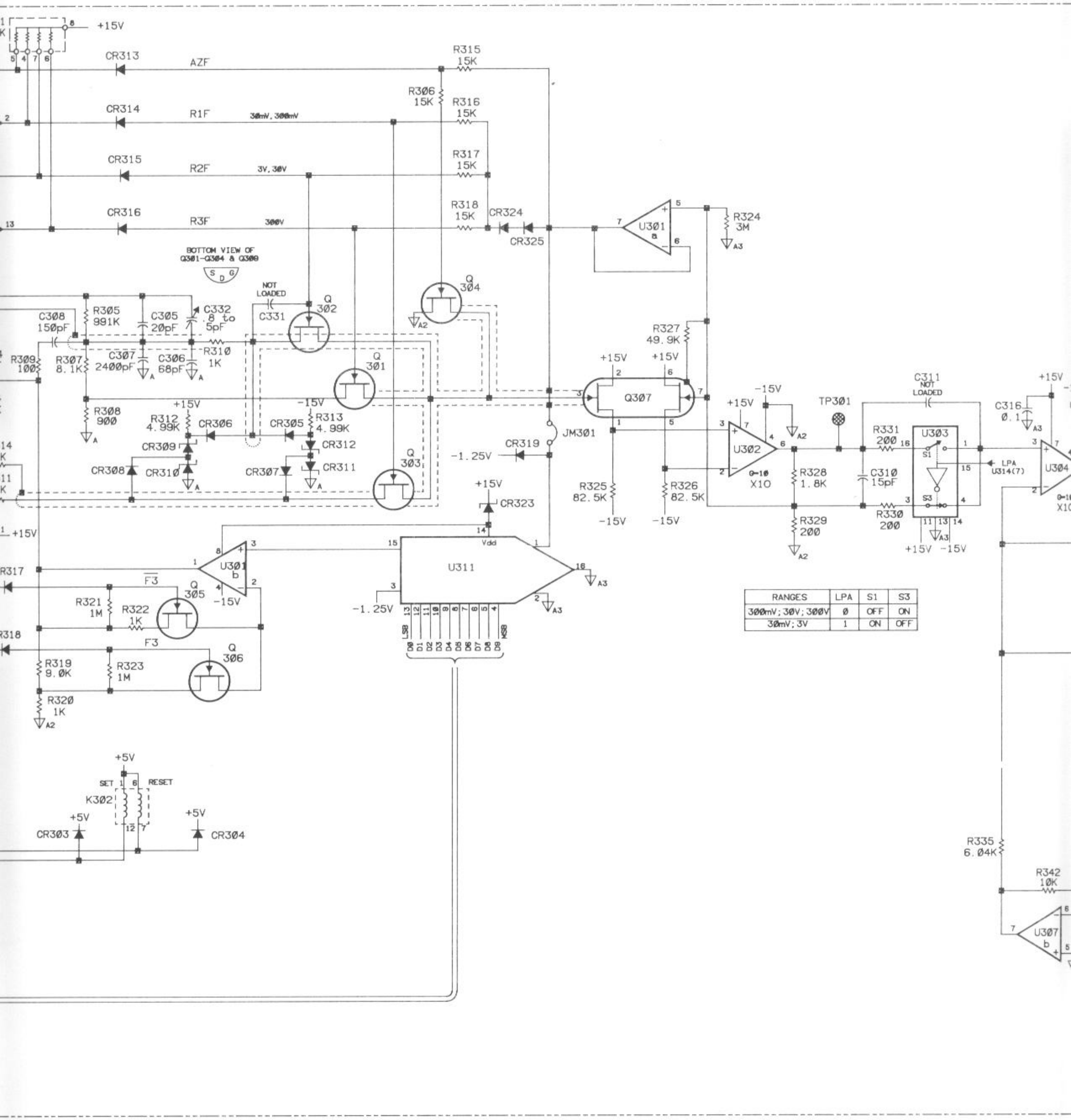

U304
U305
U306
U307
U308
U309
U310
U303
Q308
Q309
TP302
TP303
TP304
TP305
JM303
JM304
W303
VAC
DAC
FREQ
A2/2
TO J303
A2/1
13
14
20
R336
200
R365
49.9K
R366
10K
R367
30.1K
R368
130K
R369
1K
C336
10pF
CR326
-1.25V
ABS VALUE
SQUARER/ DIVIDER
Vin
Vout
RMS
CS
DEN
25K
C333
1
C334
1
R364
7.5K
R363
49.9K
R362
57.6K
C318
0.22
C319
1
C335
0.1
C312
1
C313
0.1
C314
.001
C315
6.8pF
R332
1.8K
R333
215
0-10
X10
R334
7.2K
R370
1K
HRMS
U314(12)
HFAC
U314(13)
HDC
U314(14)
LCTR
U315(11)
R371
15K
R372
15K
C320
.22
R338
1K
C323
.022
R337
200K
R343
200K
C321
100pF
R342
10K
R340
4.99K
R339
4.99K
R341
10K
C322
270pF
R345
10K
CR321
CR320
R350
1K
R346
1K
R347
20K
R348
909
R349
121K
+.088
-.107
C324
10pF
+15V
-15V
+5V
A3
D
34520 S.57.3A

FUNCTION	HRMS	S1	S3
AZERO	0	OFF	ON
MEAS.	1	ON	OFF

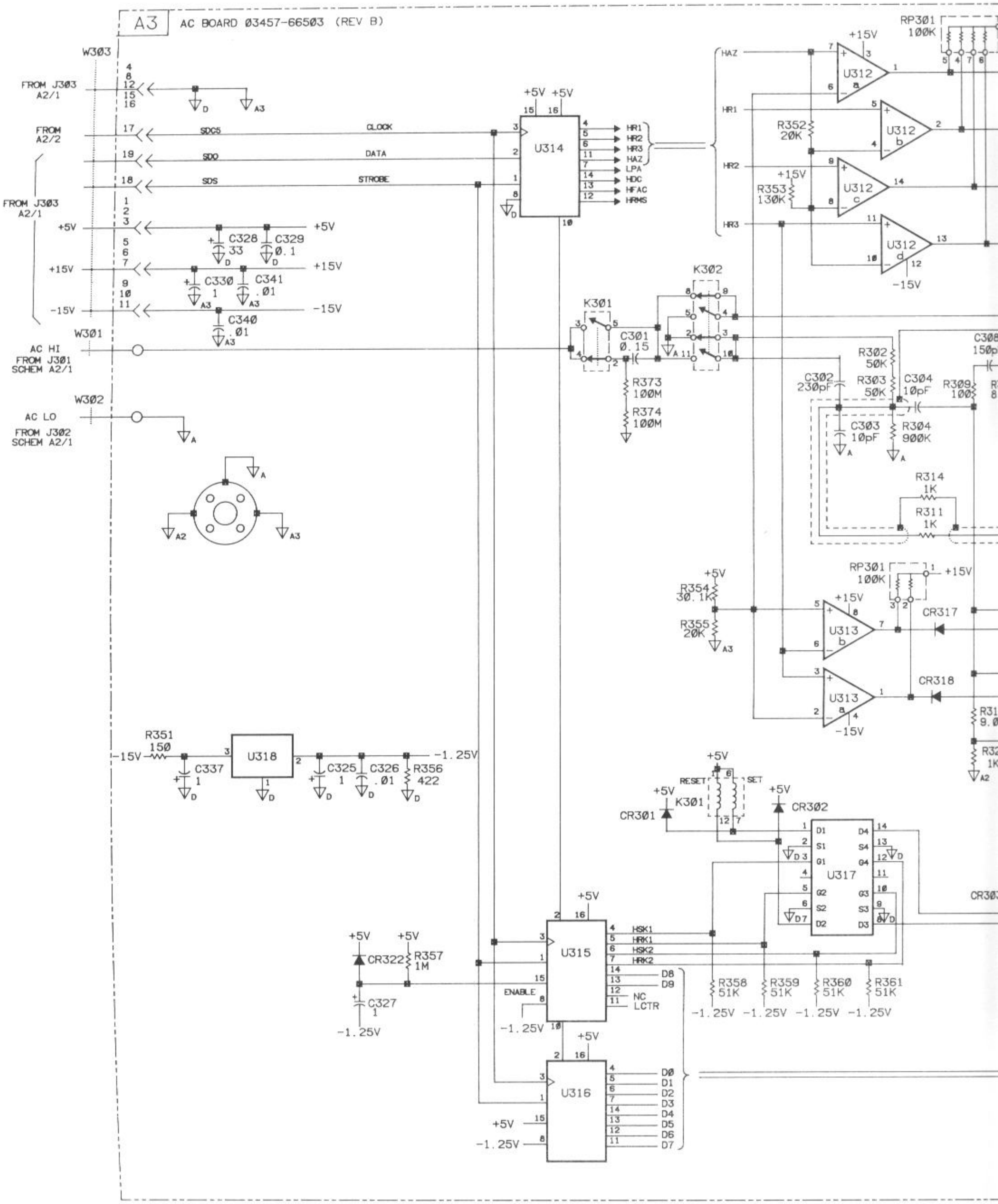
AC BAND	HFAC	S2	S4
ACN	0	OFF	ON
ACF	1	ON	OFF

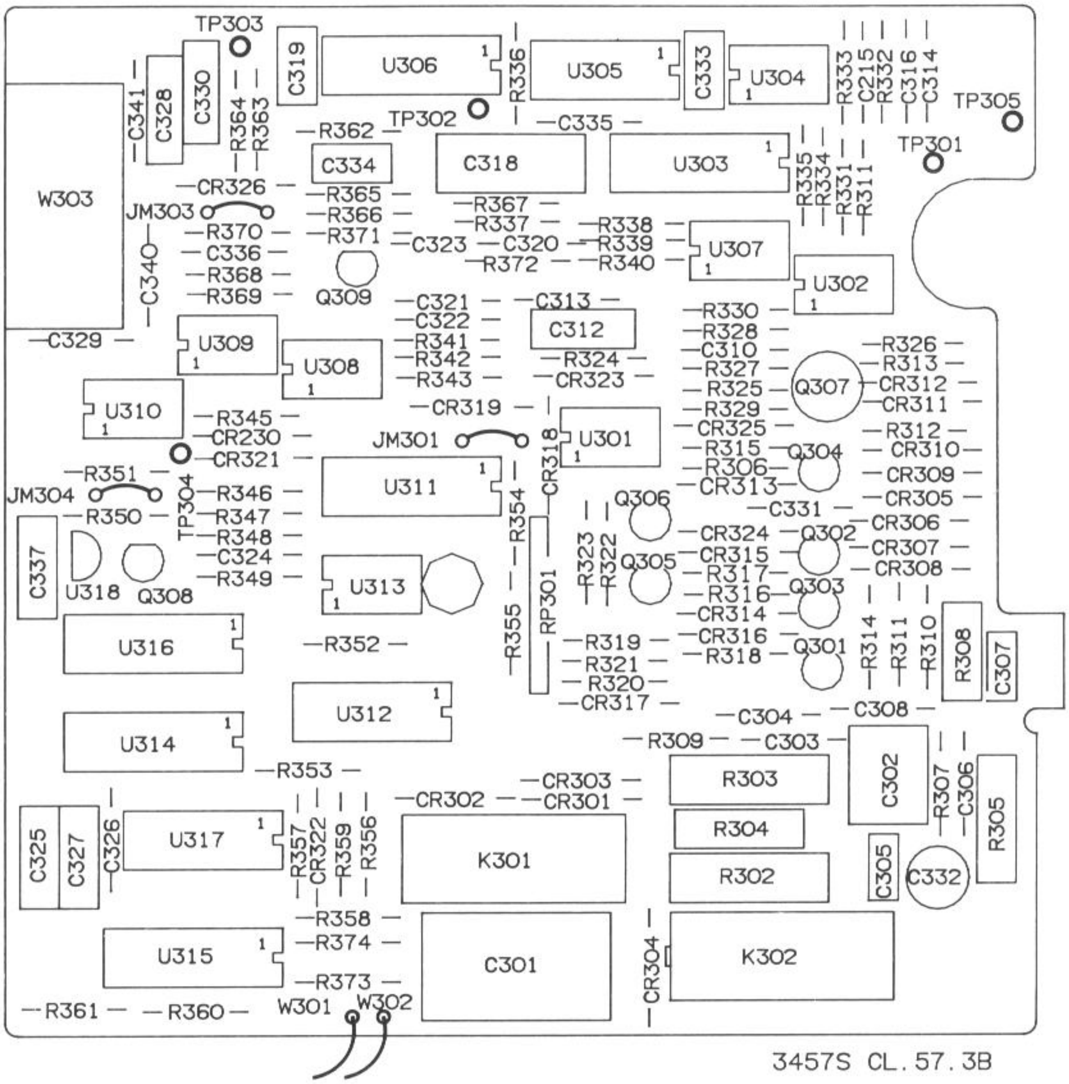
FUNCTION	HDC	S2	S4
ACV	0	OFF	ON
ACDCV	1	ON	OFF

Figure 8-24. 03457-66503, AC Converter, Rev. B


+15V
CR313
AZF
R315
15K
R306
15K
CR314
R1F
30mV, 300mV
R316
15K
CR315
R2F
3V, 30V
R317
15K
CR316
R3F
300V
R318
15K
CR324
CR325
U301
a
R324
3M
BOTTOM VIEW OF
Q301-Q304 & Q308
S D G
NOT
LOADED
C331
Q
302
Q
304
C308
150pF
R305
991K
C305
20pF
C332
.8 to
5pF
R309
100
R307
8.1K
C307
2400pF
C306
68pF
R310
1K
Q
301
R327
49.9K
R308
900
+15V
R312
4.99K
CR306
CR305
-15V
R313
4.99K
CR312
CR309
CR308
CR310
CR307
CR311
Q
303
Q307
JM301
CR319
-1.25V
U302
G=10
X10
R325
82.5K
R326
82.5K
-15V
TP301
C311
NOT
LOADED
R331
200
U303
S1
S3
LPA
U314(7)
C310
15pF
R328
1.8K
R329
200
R330
200
+15V -15V
C316
0.1
U304
+15V
CR323
Vdd
U311
U301
b
R317
F3
Q
305
R321
1M
R322
1K
R318
F3
Q
306
R319
9.0K
R323
1M
R320
1K
-1.25V
LSB
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9
MSB
+5V
SET
RESET
K302
CR303
CR304
R335
6.04K
R342
10K
U307
b

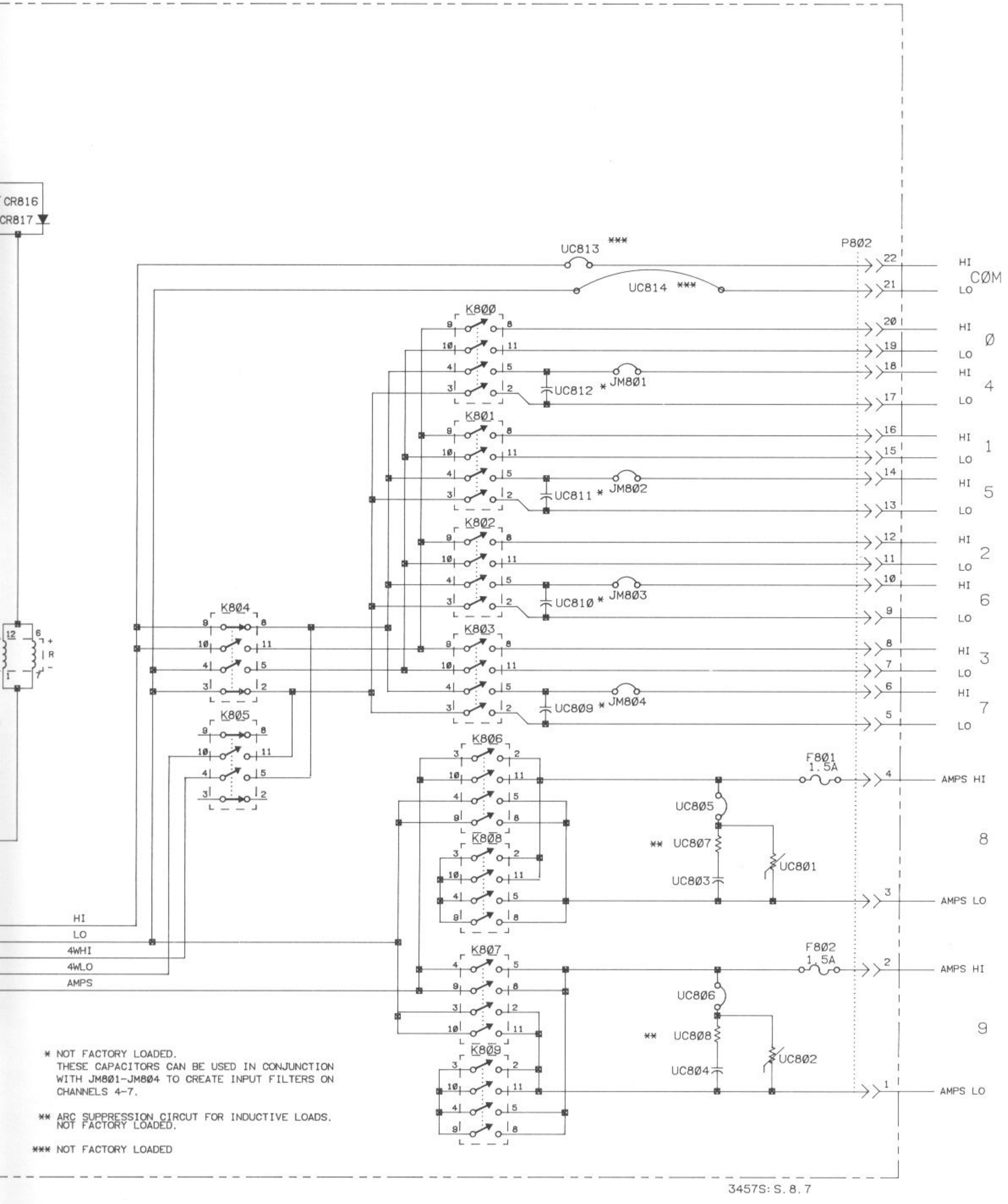
RANGES	LPA	S1	S3
300mV; 30V; 300V	0	OFF	ON
30mV; 3V	1	ON	OFF


A3
AC BOARD 03457-66503 (REV B)
W303
FROM J303 A2/1
FROM A2/2
FROM J303 A2/1
4
8
12
15
16
17
19
18
1
2
3
5
6
7
9
10
11
SDCS
CLOCK
SDO
DATA
SDS
STROBE
+5V
+15V
-15V
C328 33
C329 0.1
C330 1
C341 .01
C340 .01
W301
AC HI FROM J301 SCHEM A2/1
W302
AC LO FROM J302 SCHEM A2/1
U314
HR1
HR2
HR3
HAZ
LPA
HDC
HFAC
HRMS
K301
C301 0.15
R373 100M
R374 100M
K302
HAZ
HR1
HR2
HR3
U312 a
U312 b
U312 c
U312 d
R352 20K
R353 130K
RP301 100K
C302 230pF
R302 50K
R303 50K
C304 10pF
C303 10pF
R304 900K
R309 100
C308 150p
R314 1K
R311 1K
R354 30.1K
R355 20K
U313 b
U313 a
CR317
CR318
R351 150
U318
C337 1
C325 1
C326 .01
R356 422
-1.25V
RESET
SET
CR301
CR302
U317
D1
S1
G1
G2
S2
D2
D4
S4
G4
G3
S3
D3
CR322
R357 1M
C327 1
U315
HSK1
HRK1
HSK2
HRK2
D8
D9
NC
LCTR
ENABLE
R358 51K
R359 51K
R360 51K
R361 51K
U316
D0
D1
D2
D3
D4
D5
D6
D7


TP303
C319
U306
R336
U305
C333
U304
R333
C215
R332
C316
C314
TP305
C341
C328
C330
R364
R363
TP302
R362
C335
TP301
W303
C334
C318
U303
R335
R334
R331
R311
CR326
R365
JM303
R366
R367
R337
R338
R339
U307
R370
R371
C323
C320
R340
R372
U302
C336
C340
R368
R369
Q309
C321
C313
R330
C329
C322
C312
R328
U309
R341
C310
R326
U308
R342
R324
R327
R313
R343
CR323
R325
Q307
CR312
U310
CR319
R329
CR311
R345
CR325
R312
CR230
JM301
CR318
U301
R315
CR310
CR321
Q304
R351
R306
CR309
U311
CR313
JM304
TP304
R346
R354
C331
CR305
R350
R347
Q306
CR324
Q302
CR306
R348
R323
R322
CR315
CR307
C337
C324
Q305
R317
CR308
U318
Q308
R349
U313
RP301
R316
Q303
R355
CR314
R314
R311
R310
R308
C307
U316
R352
R319
CR316
Q301
R321
R318
R320
U312
CR317
C304
C308
U314
R309
C303
R353
CR303
R303
C302
CR302
CR301
R307
C306
R305
C325
C327
C326
U317
R357
CR322
R359
R356
R304
K301
C305
C332
R302
R358
R374
CR304
U315
C301
K302
R373
R361
R360
W301
W302

3457S CL.57.3B

HP PART NO. 03457 66503
REV B

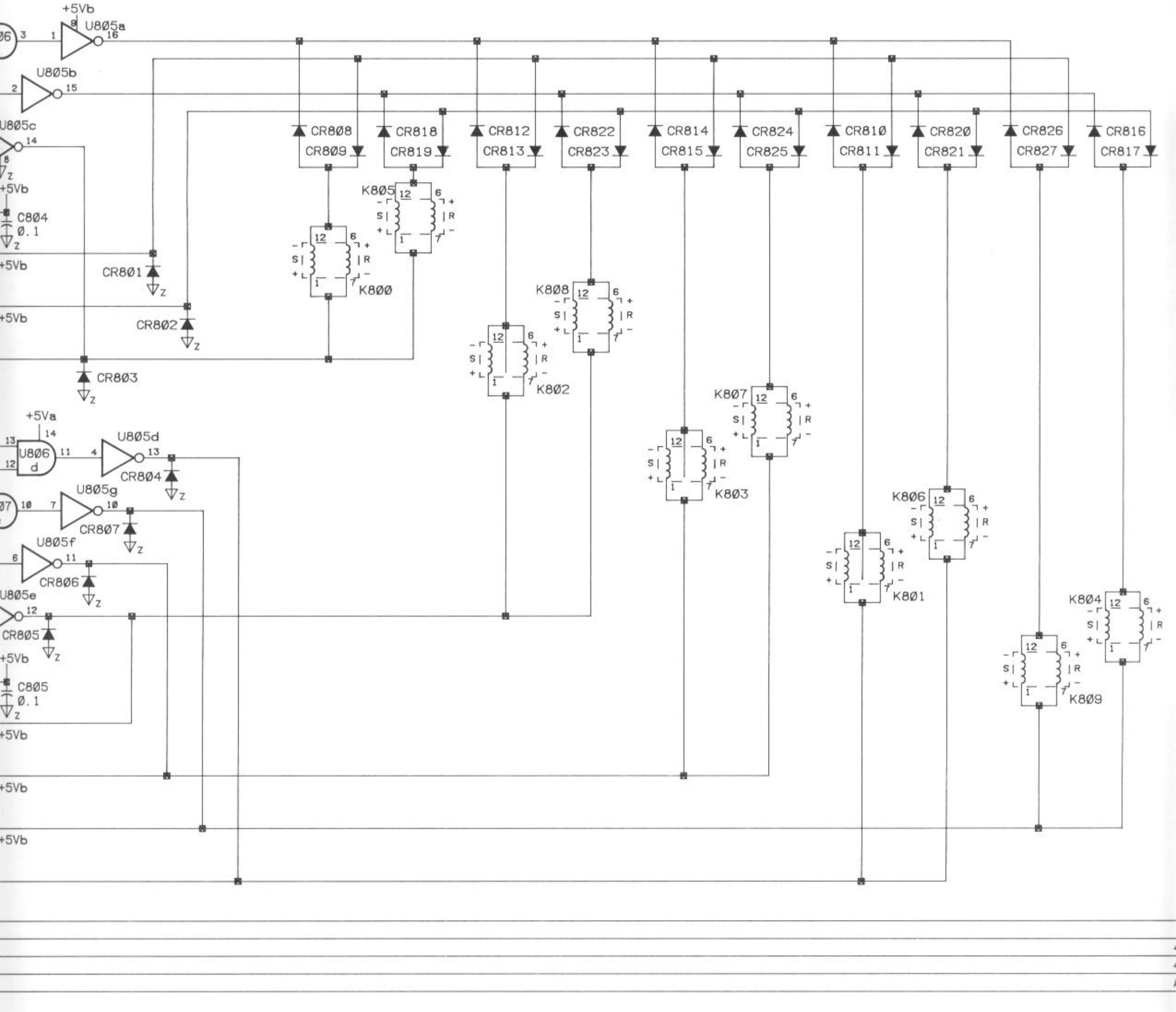

CR816
CR817
UC813 ***
UC814 ***
P802
K800
K801
K802
K803
K804
K805
K806
K807
K808
K809
UC812 *
UC811 *
UC810 *
UC809 *
JM801
JM802
JM803
JM804
F801 1.5A
F802 1.5A
UC805
UC806
** UC807
** UC808
UC803
UC804
UC801
UC802
HI
LO
COM
HI
LO
0
HI
LO
4
HI
LO
1
HI
LO
5
HI
LO
2
HI
LO
6
HI
LO
3
HI
LO
7
AMPS HI
AMPS LO
8
AMPS HI
AMPS LO
9
HI
LO
4WHI
4WLO
AMPS
R
3457S: S. 8. 7

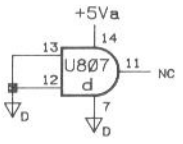
* NOT FACTORY LOADED.
THESE CAPACITORS CAN BE USED IN CONJUNCTION WITH JM801–JM804 TO CREATE INPUT FILTERS ON CHANNELS 4–7.

** ARC SUPPRESSION CIRCUT FOR INDUCTIVE LOADS. NOT FACTORY LOADED.

*** NOT FACTORY LOADED

Figure 8-25. 44491-66501, General Purpose Relay Card, Rev. A3


+5Vb
U805a
U805b
U805c
U805d
U805e
U805f
U805g
U806 d
+5Va
C804 0.1
C805 0.1
CR801
CR802
CR803
CR804
CR805
CR806
CR807
CR808
CR809
CR810
CR811
CR812
CR813
CR814
CR815
CR816
CR817
CR818
CR819
CR820
CR821
CR822
CR823
CR824
CR825
CR826
CR827
K800
K801
K802
K803
K804
K805
K806
K807
K808
K809
S
R
Z

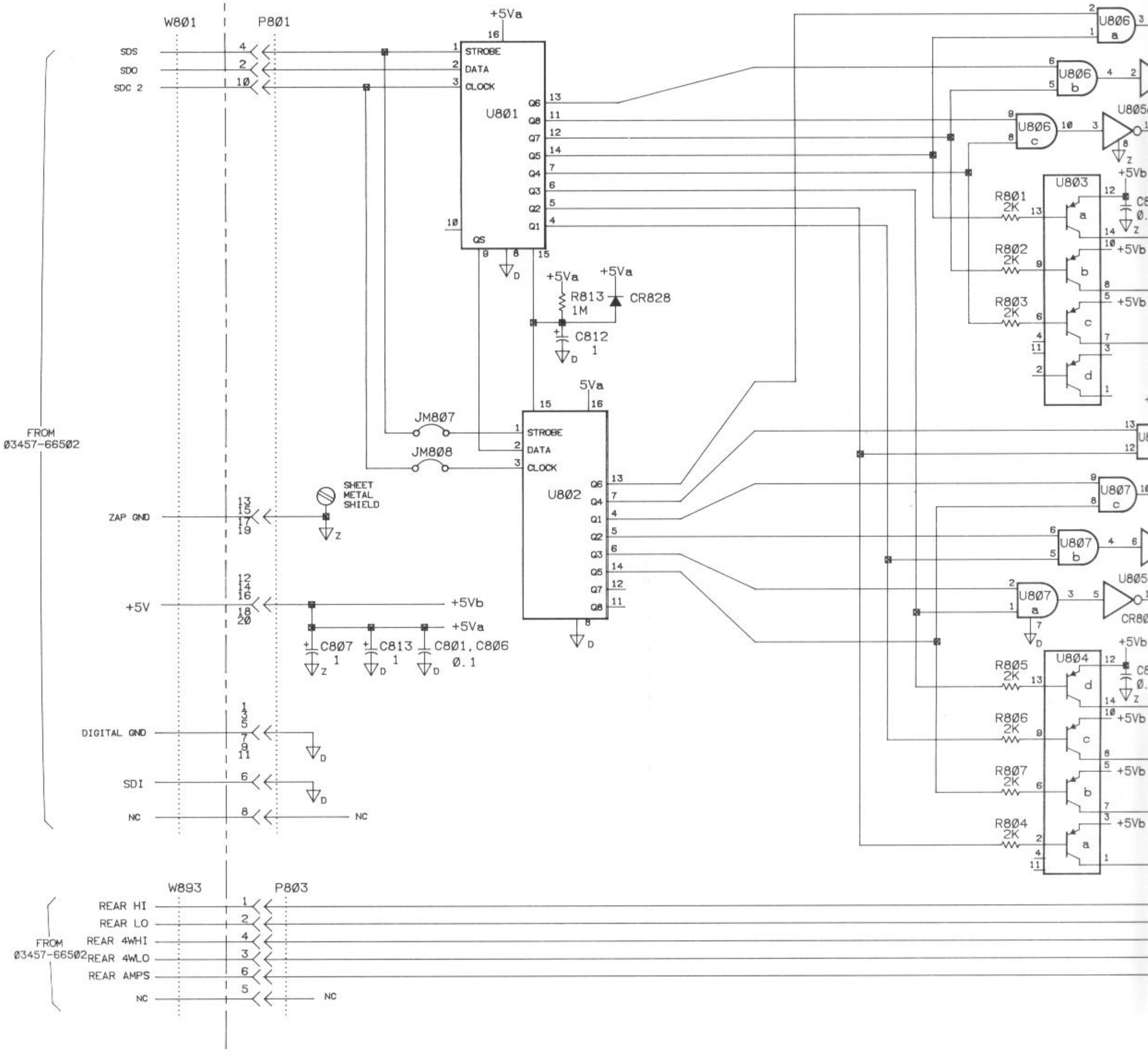

+5Va
U807 d
13
12
14
11
7
NC
D

* NO
TH
WI
CH

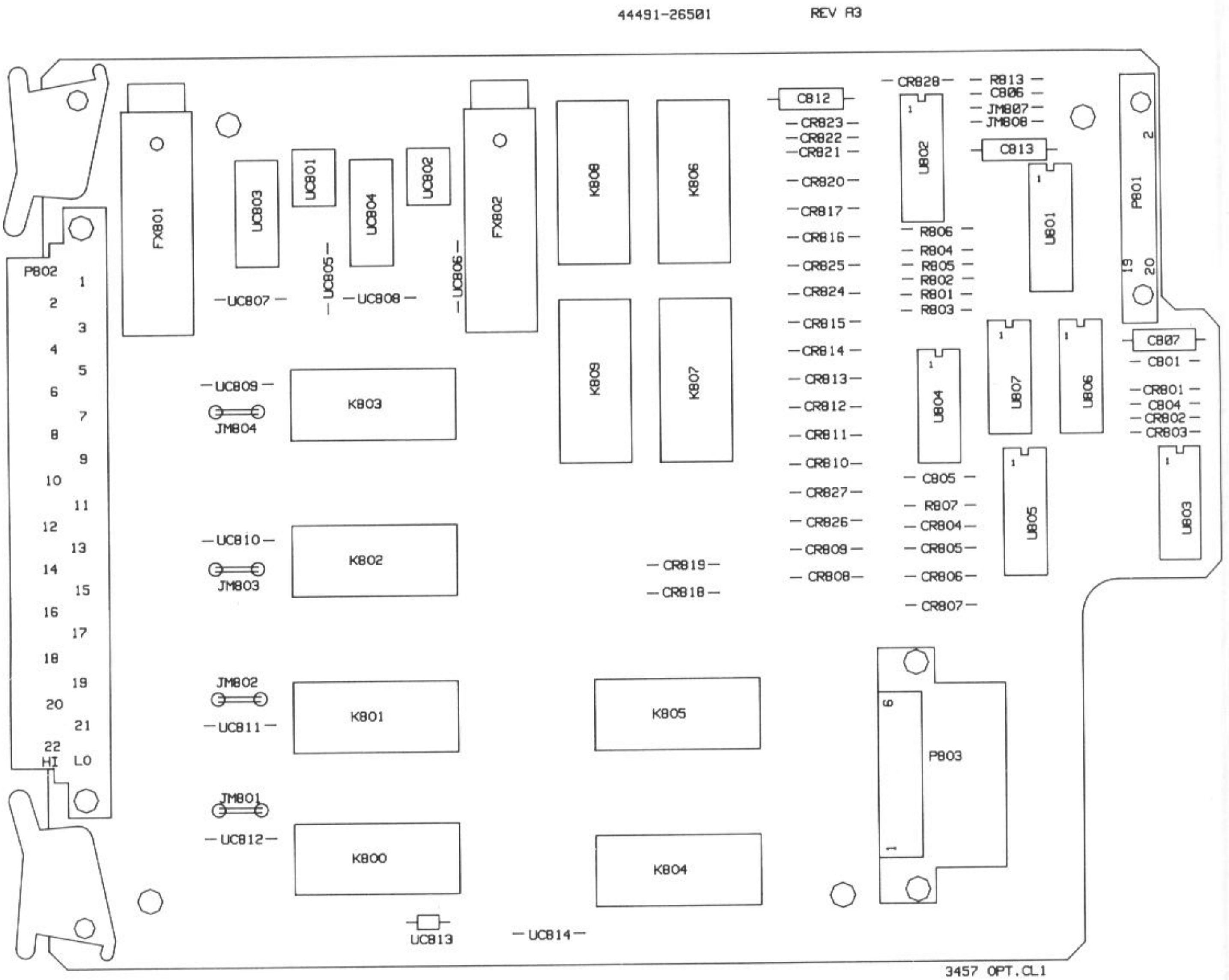
** AR
NO

*** NO

A1 GENERAL PURPOSE RELAY CARD 44491-66501 REV. A3
(3457A OPTION)



W801
P801
SDS
SDO
SDC 2
FROM 03457-66502
ZAP GND
SHEET METAL SHIELD
+5V
+5Vb
+5Va
C807 1
C813 1
C801, C806 0.1
DIGITAL GND
SDI
NC
U801
STROBE
DATA
CLOCK
QS
R813 1M
CR828
C812 1
JM807
JM808
U802
5Va
U806 a
U806 b
U806 c
U805
U803
R801 2K
R802 2K
R803 2K
U807 a
U807 b
U807 c
U804
R805 2K
R806 2K
R807 2K
R804 2K
CR80
W893
P803
REAR HI
REAR LO
REAR 4WHI
REAR 4WLO
REAR AMPS


44491-26501
REV A3
FX801
UC803
UC801
UC804
UC802
FX802
K808
K806
C812
CR828
R813
C806
JM807
JM808
U802
C813
U801
P801
2
19
20
CR823
CR822
CR821
CR820
CR817
CR816
CR825
CR824
CR815
CR814
CR813
CR812
CR811
CR810
CR827
CR826
CR809
CR808
R806
R804
R805
R802
R801
R803
UC805
UC806
UC807
UC808
K809
K807
U804
U807
U806
C807
C801
CR801
C804
CR802
CR803
C805
R807
CR804
CR805
CR806
CR807
U805
U803
P802
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
HI
LO
UC809
JM804
K803
UC810
JM803
K802
CR819
CR818
JM802
UC811
K801
K805
9
1
P803
JM801
UC812
K800
K804
UC813
UC814
3457 OPT.CL1

Errata

Title & Document Type: 3457A Multimeter Service Manual

Manual Part Number: 03457-90012sg

Revision Date: February 1988

HP References in this Manual

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